Empirical Research in Evolutionary Economics

The Potential of the 'Social World Perspective'

A thesis submitted to the University of Manchester for the degree of M.Sc.

2004

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PREST

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Abstract

History matters in economics as well as in the social sciences generally. In his study of the entrepreneur, Schumpeter has shown, in opposition to neoclassical economics, that the economic system faces ongoing disturbances and that it does create these itself. Furthermore, he insisted that the capitalist system requires these disturbances, caused by entrepreneurial activity, in order to expand. With this conception Schumpeter has been one of the main references for evolutionary economic theorists. They, likewise, are interested in economic processes and in the forces of disruption and emergence. And like Schumpeter, they claim that in order to explore these phenomena there are other tools necessary than those applied by neoclassical theories.

This dissertation shows, in the first part, how Schumpeter's investigation of the entrepreneur has been connected with evolutionary economic concepts up to the present. In this part there are raised also some questions about suitable frameworks for evolutionary economic research. The second part introduces a sociological frame, the social world perspective, which emphasises likewise processes and emergence within social aggregates. It is shown the similarity of this approach and suggested a connective relation to evolutionary economics. The third part will discuss this connection in detail by raising questions about the current empirical state of the evolutionary economic framework and the potential contribution of the social world perspective during this state. An explanatory case will serve as empirical data in order to reinforce the argument. The dissertation closes with some discursive reflections on existing frameworks of evolutionary economics as well as on potentially applicable frameworks for forthcoming research.

Declaration

A review of the ‘social world perspective’ (pp. 30-33) has been done in a significantly different way – with another focus and other focal points as well as with partly different sources – in my Diploma Dissertation in Sociology at the University of Bielefeld / Germany, 2003.

Introduction

Throughout the 20th Century, investigating the society's economic sphere has almost exclusively been the task of neoclassical economics. Its oversimplifications, which are manifested in conjectures about profit maximising behaviour and actors' perfect knowledge, and its insistence on a closed and static market-system, has ruled policy makers throughout this time. But all the time there did exist alternative models of explanation of economic life. One of these is the work of Josef A. Schumpeter. He challenged the neoclassical model as early as on the beginning of the 20th Century when he investigated the phenomenon of innovation. Neoclassic theories were not, and are not up to now, able to incorporate the factor of emergence into their models. Innovation as emergent social phenomenon suggests referring to theories that cope with dynamic processes over time – most obviously with evolutionary processes. The Schumpeterian theory is, hence, one of the main roots on which evolutionary economics rests. Apart from questions about the detailed form of evolution – whether it is a Darwinian or rather a Lamarckian scheme – evolutionary economists are in agreement with the presupposition that economic development happens in a frame of variation, heredity, and selection over time.

In evolutionary economics almost all basic assumption are different from neoclassical ones. Hence, its methods of analysis must significantly differ from the latter. Like in many academic disciplines the development of methodological tools and theoretical frameworks in evolutionary economics is a lengthy endeavour, which is far from being finished. Up to now its presuppositions are broad enough so that many scientific disciplines can contribute to the development of this theory. It, indeed, does not incorporate narrow assumption about human characteristics and abilities like neoclassical theories does. In this respect, evolutionary economics is an adoptable and open scientific scheme. This, of course, is not only beneficial but bears also some disadvantages. At a certain degree it is necessary to simplify in order to be able to build models or to do population research – two of the main analytical means of evolutionary economics. But the question is whether findings of more detailed analysis in parts of the theory or contributions from other academic disciplines contradict the basic assumptions. This is what happens all along with neoclassical theories. In cases of contradiction they search rescue in auxiliary assumptions.

Up to now, therefore, evolutionary economics is in a stage in which it may welcome variations of academic endeavours that can contribute to offer a broad picture about the evolutionary development of capitalism – an academic division of labour so to speak. With this work I want to contribute to the development of this broad picture with a discussion about the potential of implementing sociological frameworks, particularly the *social world perspective*, into evolutionary economics. A first, but rather non-systematic, review of the topics in evolutionary economics, like

they are treated in the *Journal of Evolutionary Economics*, has led me to the assumption that certain fields of sociology, especially micro-sociological approaches, may to a certain extent be neglected. Speaking, for example, about the economic actor as individual and referring solely to psychology seems to me being quite anachronistic, at least if we follow the developments of 20th Century philosophy of language and knowledge, and especially if we want to call economics still a social science. I will raise questions about some of those issues at some parts of this work. My main objective is to arouse some interests about the explaining power of sociological frameworks, especially when they can, likewise, show characteristics of evolutionary processes. Being receptive to such perspectives can be helpful in order to develop analytical frameworks for the yet to come evolutionary economics.

In order to meet the task this work restricts the description of evolutionary processes and focuses only on parts of those processes. Special emphasis lies on entrepreneurial activities at the beginning of innovative processes. Therefore, not all steps of the evolutionary process will be dedicated in the like manner. Variation and its emergence may be treated more in detail than, say, the process of restructuring. With concentration on the Schumpeterian entrepreneur, other roots of evolutionary economics may also suffer neglect in this work, even though they may incorporate some similar sociological assumptions like those that I will introduce (e.g. institutional economics with its reference to American pragmatism, cf. Hodgson and Knudsen 2004). In evolutionary economics there are already many analytical tools available, such as (historical) case studies, modelling, or population research. Even though this work is about empirical research these tools cannot be explained in detail. This work is concerned rather with the prerequisites of analytical instruments, and in order to put my arguments forward, an outline of evolutionary economic instruments should be sufficient.

In **Part I**, I will give a brief outline of the history of evolutionary economics. Beginning with Schumpeter's investigation of entrepreneurial activity the first task is to draw a distinction between neoclassical theories and the framework of evolutionary economics. Schumpeter was not impressed by the idea that the economic system might not be stable. According to him, it cannot be as long as it is to progress. The entrepreneurial function is crucial at this point. It is the cause of the system's fluctuation, and, hence, the source of development of the capitalist system. Succeeding Schumpeter, who has had mixed impressions about the analogy between economic processes and Darwinian evolution, evolutionary economists has been discussing the usefulness of this analogy. Up to now many concerns that Schumpeter may have had in mind have not yet been dispelled. Routine behaviour in analogy to genes, for example, is lacking the stable characteristics of genes, which is necessary in order to serve as unit of selection. Therefore, new approaches abstract from biology and see evolution as the course of history in general terms. This is

what makes evolutionary economics a *grand* theory in which many academic endeavours, middle-range theories of different academic fields, can find their home.

Part II will introduce with the ‘social world perspective’ a sociological framework that meets in many respects the needs of evolutionary theorising. It emphasises that social life is to be seen as process, and even, as we will see, as evolutionary process. It dismisses assumptions of stable structures, in sociology prominent for a long time, and refers to action based phenomena that show also structural tendencies but are much more open for change. An example about the co-evolution of knowledge and industrial innovation is to show the similarities to evolutionary thinking in economics. Another case, which is concerned rather with individual action on the micro-level, may show how the social world perspective can be used on different layers of societal aggregations.

In **Part III**, the current state of evolutionary economics will be recapitulated briefly. I will show how the social world approach with its concentration on common activities can be used as a basic framework for case studies and for the exploration of observables that could be used in order to formulate evolutionary models or questions for population research. One extra section is concerned with the emergence of variation. I will briefly introduce some micro-sociological perspectives, resting on interactionism and phenomenology, that highlight economic phenomena that may not be taken into account sufficiently but that, nevertheless, can have a large potential for future research. While these sections of Part III are more concerned with the heuristic potential of different perspectives in order to indicate, for example, units of selection, the last section is rather closely concerned with the process of variation, heredity, and selection. I will give a brief outline about the evolution of communication and suggest a possible application in evolutionary economics.

Part I: Evolutionary Economics as Grand Theory

Evolutionary economics does not share many conjectures with the neoclassical theory that still dominates economic thinking. Nevertheless, it is not separated as an isolated endeavour. Its roots date back, first, to contemporary theories that were challenging neoclassical economics. One of the most important in this respect is the theory of capitalist development by Josef A. Schumpeter. He developed a framework that is partly dedicated to historical schools that were the major conception in many countries within the 19th Century. Others such as Marx also played an important role for Schumpeter. Another root may be seen in evolutionary thinking that has its main manifestation in the Darwinian scheme. In both these very different fields of academia some phenomena that are important in order to investigate processes, be they social, economical, or biological, show remarkable similarities, such that investigating these phenomena offer a framework for economic thinking in its own right. They are not compatible at all with dominant neoclassical theories and call for replacement of the existing *grand* scheme of economic theorising.

1 Schumpeter's Theory of Innovation

a) Unstable Economic Systems

One of the main sources of evolutionary thinking in economics derives from the works of Josef A. Schumpeter. He challenged the neoclassical assumption that normality in an economic system is an equilibrium state constituted by prices where the quantity supplied equals the amount of commodities demanded, and that disequilibrium must come from forces outside the economic system. Apart from changes that are obviously driven by factors outside an economic system – e.g. by wars, dictatorships, environmental catastrophes, or political decisions that influence the economic system –, Schumpeter (1928) asked whether the system is stable in itself. If factors other than mere economical ones disturb economic action, Schumpeter would have spoken of an unstable "capitalist *order*", not of an unstable "capitalist *system*" (1928: 363). Order is the underlying precondition of capitalism as a whole, a certain kind of social order, or societal order respectively. The system, on the other hand, reflects the "business conditions" within the capitalist order (1928: 362). At this point Schumpeter wanted being taken for granted that the capitalist system – "characterised by private property (private initiative), by production for a market and by the phenomenon of credit"[1] – is analytically distinguishable from other social spheres (ibid.).[2]

[1] When speaking about the *economic system* for the rest of this work, I mean this kind of *capitalist system*. There might be other economies like feudalism or socialism that do not have the characteristics Schumpeter is addressing in his 1928 essay (cf. Schumpeter, quoted in Rosenberg 2000: 15).

[2] In those days he referred to Marxist theories that did not make this division.

In so far, he agreed with the neoclassical economists of his time. Furthermore, he felt free to observe a "static state" (1928: 373) that represents economic stability: "Economic life, or the economic element in, or aspect of, social life might well be essentially passive and adaptive and *therefore, in itself, essentially stable*." (1928: 374). However, motions may exist in terms of the ordinary economic exchange among agents, in terms of certain seasonal frequency effects, and of growth or decline of agency population or economic factors. These, however, do not disturb the static economic setting (1928: 373).[3] Nor does the expansion of industries expel the assumption of a static state as long as it is induced by social growth or other non-economic factors (1928: 375f.).[4]

In this respect Schumpeter, again, followed the most neoclassical economists. The phenomenon he was concerned with deals with the question: What creates expansion in the first place, apart from the exogenous factors mentioned above? For Schumpeter this must be *innovation*. An industry

> "expands its own production, thereby creates an expansion of demand for its own and, contingent thereon, other products, and the general expansion of the environment we observe – increase of population included – is the *result* of it". (1928: 377)

Innovations in this respect are the

> "means of new combinations of existing factors of production, embodied in new plants and, typically, new firms producing either new commodities, or by a new, i.e. as yet untried, method, or for a new market, or by buying means of production in a new market." (1928: 377f.)[5]

Schumpeter labelled such kind of economic action, and the role of it within the economic system, the entrepreneurial function (1928: 380). It is the essential phenomenon that induces economic change *from within* the economic system. Schumpeter made clear that it is not advisable to bring innovations too near with the notion of invention. The latter is a fairly different phenomenon (1934: 89; 1928: 366). Carrying out inventions has nothing to do with the entrepreneurial function in the first place. Only when they are introduced into a market they become innovations (Fagerberg 2003: 131). According to Schumpeter, there cannot be spoken of any

[3] In this essay Schumpeter made the sharp distinction between order and system in order to put his argument of endogenous change forward. The expressions *order* and *system* are not analytical ones in Schumpeter's work. Later on he used them rather non-analytically, e.g. in Schumpeter (1947: 83) where he spoke of "economic structure" and "economic system" synonymously. However, the notion of *order* expresses the existence and validity of rules whereas *system* refers rather to the expression of relations. So, these are two rather different qualities. The business conditions *are* ordered – by political, ethical etc. rules, but also by procedures of "co-ordination", i.e. the market (Metcalfe 1998: 85).

[4] This characterisation might come nearest to an economic period that Schumpeter called "circular flow". It is "the state of affairs in which ordinary businesses and routines prevail in the behaviour of economic agents, and where nothing significantly new happens even if some data change due to exogenous disturbances" (Witt 2002: 12).

[5] In his earlier work, Schumpeter mentioned five different cases of new combinations: "(1) The introduction of a new good[..]. (2) The introduction of a new method of production[..]. (3) The opening of a new market[..]. (4) The conquest of a new source of supply of raw materials or half-manufactured goods[..]. The carrying out of the new organisation of any industry[..]." (1934: 66)

equilibrium as long as people take action in order to achieve new ways of producing or selling goods, or in order to create new markets by establishing new products.

Coming back to the distinction between system and order, Schumpeter argued that an economy could cope well with the outcome of the establishment of these novelties. Even if they cause instability of the system, the economic order will not be harmed. Schumpeter identified self-corrective phenomena that stabilise the economy (1928: 383f.): innovations will be copied, hence the economic outcome to an innovative firm, profit, will diminish over time; firms that do not stick to the new developments pass away. However, as Schumpeter only briefly stated at the end of this article, this kind of process within the economic system would come to an end. It only describes a capitalist system in which the single entrepreneur, heroically, faces the uncertainties and obstacles of economic life. The so-called "trustified" economy, consisting of large companies that do not stick to such kind of entrepreneurship but force novelties in quasi automatised ways, and in which personally risk-taking is absent, is the beginning of a mentality that will bring the innovative source of economic processes to an end.[6] This, remember that the article is entitled *The Instability of Capitalism*, would be a threat for the capitalist order, too.[7]

b) The Entrepreneurial Function

The phenomenon that Schumpeter has introduced into economic science: novelty creation by an entrepreneur, his insistence into the intrinsic character of innovative processes, cannot – according to a Schumpeterian style of economic theorising – be integrated into a theory that pronounces the stability of an economic system in that there is an ongoing equilibrium, and in that this equilibrium is disturbed from outside. Following the neoclassical understanding of equilibrium, where a given amount of supply is facing a given amount of demand, and where those phenomena generate a market equilibrium – which is the point where any amount of supply will find a certain amount of demand, and which, hence, creates the price of a commodity[8] –, homo oeconomicus can only react to chances that are given by the system itself. Hence, in introducing the creation of novelty into neoclassical analysis the change must come from outside the system. But to position entrepreneur's action outside the economic system is like positioning any other economic action outside the system. It will destroy its very analytical basis.

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[6] In later works Schumpeter (1939a; 1939b; 1947) investigated these phenomena – the self corrective processes and the consequences of a trustified economy – in detail. Further below, I will come back to these phenomena, as well as to the role of the entrepreneur that Schumpeter has described in an earlier work (Schumpeter 1934).

[7] There are ongoing debates about Schumpeter's differentiation between entrepreneurial and trustified economic action. Is it a real historical development from the first to the latter or is the older theory of the entrepreneur obsolescent? I do not follow this discussion but see for a recent contribution Langlois (2002).

[8] When speaking of a "general equilibrium" I mean an aggregative function, where a whole set of different goods and services is taken into account. A general equilibrium is to describe the whole economy, where supply and demand of some goods and services have impact to supply and demand of others.

Schumpeter, rather than criticising static analysis as such, criticised the non-restrictive usage of it. It might be well possible to investigate economic relations that base on a system of values and variables that remain stable. However, when such values and variables come into play that refer to, for example, expectations, this kind of analysis has its problems. Similarly, static analysis might be possible, if the values and variables change due to well expectable processes within an economy ("adaptive response"). If those changes derive from techniques outside the routine ("creative response") it would fail.[9] Entrepreneur's action is such a phenomenon. Speaking about the creation of novelty implicates non-routine processes. And whenever speaking about industrial revolution, technological development, and – not least – economic development, the notion of innovation must be at the core of the analysis. Hence, the focus of a Schumpeterian style of economic theorising must be on the role of the entrepreneur in the economic system.

In addition to his opposing view of the characteristics of the economic system, Schumpeter did not share the neoclassical position that economic individuals have the same motivation and knowledge, that each individual is equally orientated on profit maximisation and that all have perfect knowledge. The difficulties of such assertions can be observed especially in the role of the entrepreneur. Apart from well calculative action, the entrepreneur does not know how well the novelty he introduced will be adopted. As unpredictability is the very nature of the phenomenon *novelty* (Witt 1992: 406) there is no tool available beforehand to prove whether his innovation is successful. Hence, the question arises, what is it that lets the entrepreneur take the risk to invest money and time in order to head towards incalculable paths of economic action?[10] According to Schumpeter, actions bearing such risks require certain psychological properties.[11] In his early work Schumpeter investigated such human related conditions. Instead of general motivation structures that count for all human, he insisted on qualities such as "conscious rationality, intuition, perceptiveness, will, and leadership" (Kelm 1997: 116).

The first two are task-oriented qualities; the second two are psychological ones (cf. Schumpeter 1934: 86). As the paths that the entrepreneur dares to go are unknown beforehand, his action must be even more conscious than in an environment that only needs routine operations. "Intuition" is needed, as success cannot be proved at the moment, when the entrepreneur decides to invest time and money into a certain novel combination of (existing) economic factors (Schumpeter 1934: 85). Once he has decided to invest, he has to be careful in all steps of his business. The process of innovation is accompanied with trial and error learning processes (Camp-

[9] On adaptive and creative response, Schumpeter's notion of a static or stationary state, and the limitations to such an analytical device, cf. Kelm (1997: 100f.).

[10] In the strict definition of his function, the entrepreneur is *not* the capitalist, although he can be both (cf. Schumpeter 1934: 75; 137). So the entrepreneur as actor needs not always taking the risk of loosing money.

[11] "Successful innovation is [..] a task *sui generis*. It is a feat not of intellect, but of will." (Schumpeter 1928: 379)

bell 1987b); big and minor mistakes go along with it. The next step could always be the last one. Attracting new customers and involving the right cooperation are tasks that require circumspection (1934: 87). After all, entrepreneurial action requires a large extent of rational thinking. But as the introduction of innovations is a process that is accompanied with ongoing uncertainties, rationality itself cannot be seen as a general quality of the entrepreneur. Rather, the rationale is in flux. As ongoing learning is involved it is changing throughout the process. It is quite clear that this description of the situation contradicts the neoclassical assumption of perfect knowledge at all stages. It follows rather Polanyi's notion of tacit and personal knowledge (Polanyi 1969), and Simon's notion of bounded rationality (Simon 1986).[12]

Furthermore, the entrepreneur has to cope with impediments in the social sphere, e.g. "legal and political" ones (Schumpeter 1934: 86). Other phenomena such as habits lead to certain kinds of reluctance to novelties. In many situations, not only within his business, the entrepreneur has to cope with such conservative tendencies. Because of these difficulties and because of the conservative environment, the entrepreneur carries certain psychological qualities and certain motives. These are not capitalistic ones in the first place. In Ulrich Witt's interpretation of Schumpeter (Witt 2002: 13), qualities like "the sensation of power, leadership and authority", and further, "the will to conquer, the impulse to fight, and the satisfaction derived from getting great things going" are more important for the entrepreneur's motivation than the mere expectance of big profits.[13] If the entrepreneur's innovation is successful, and if it carries out financial profit at the end, imitators will follow and copy this innovation in order to make profit themselves. The entrepreneur's massive profit, if he was lucky to make it over a certain time, tends to fade away in the competitive environment;[14] the novelty as innovation adapts to its economical environment, and its innovative character tends to vanish. Here again, the neoclassical profit maximising paradigm is running short. It fails to take into account such different, and probably more important, motivation-structures.

With his insistence on the importance of the entrepreneur's role in the economic system, Schumpeter offers a supply-derived approach (Metcalfe 2004: 163). As

[12] Following Polanyi, there is a kind of knowledge that cannot be transferred by textbooks or other educational means. It shows rather the characteristics of crafts, which have to be trained practically. For Simon knowledge is bounded to the context of the knowledge carrier. Hence, it is never given perfectly to all.

[13] "Only later, in the context of a discussion of the surplus [..] is the profit motive mentioned." (Witt 2002: 13) Indeed, this interpretation is supported by the fact that Schumpeter describes these psychological qualities in a chapter called "The Fundamental Phenomenon of Economic Development" (Schumpeter 1934: 57ff.).

[14] At this point Witt (2002: 14) raises doubts whether Schumpeter is right in his characterisation of the entrepreneur as "the most gifted" because of his special ability to force the difficulties of introducing novelties. Be it so then, according to Witt, it is difficult to understand why he does not foresee that the less gifted innovators will force his profits. I do not think that this contradicts Schumpeter's arguments. The notion "gift" carries many different qualities; furthermore, it carries the combination of different qualities, which composes a certain personality structure. Maybe – the following is not a hypothesis but rests solely on a deductive derivation from Witt's summary of Schumpeter – innovators share a structure of gifts with which they have a low potential to foresee the future on the one hand, but very much will to conquer the future on the other.

Schumpeter said, the majority of economic actions is adaptive, and hence represents the conservative forces within a process over time.[15] But once an outcome of entrepreneurial action has success and is called an innovation, this very incident will cause a kind of disturbing impact to the system. Established business routines are facing changes or are replaced as new innovative processes lead to cheaper costs per unit; markets vanish because new ones, more modern ones, drive them out, etc. Most of the entrepreneur's psychological qualities refer to future expectations in that the entrepreneur is hoping for an outcome that is well suited. But the path to this outcome is not very well paved. With a mere adaptive response to the environment, means: with only using the well-known paths, there would be no expectation that the future might bear large profits.[16] In fact, this would constitute a stationary economy. But a capitalist economy can be expected to be "restless" (Metcalfe 2004), because generating knowledge – "through thought experiments in individual minds" (2004: 177) – is a basic element of human life. Hence, the entrepreneur's role provides the economic system with a "self-organisational impetus" (Foster 2000: 319). This self-organising drive leads to a higher degree of order within the economic system. Schumpeter's entrepreneur incorporates the function to disturb the system by "de-correlating" existing and common knowledge about courses of business (Metcalfe 2004: 167f.). The following process of adaptation leads to a higher degree of order. This is a rather non-functional process but a "one-to-many mapping, or bifurcation" (Foster 2000: 318) – i.e. evolution. Investigating the entrepreneur's role must be, according to Schumpeter, the core of investigating the development of capitalist economies.[17]

2 Schumpeter and Evolution

Many of the elements in Schumpeter's work refer to theories that share the assumption that processes have to be seen as evolutionary. The most prominent among these are biological ones, namely those of Darwin and Lamarck. Even though

[15] Schumpeter remembers us that it is to be seen as a "rule" that innovations do not derive from consumers. The entrepreneur induced novelties into the society. For Schumpeter it is "fact that the spontaneity of wants is in general small. [..] It is, however, the producer who as a rule initiates economic change, and consumers are educated by him if necessary; they are, as it were, taught to want new things" (Schumpeter 1934: 65). A critique against the insistence on innovation-supply dominance raises Witt (2002: 15): "This ignores such features as innovative buying and consumption activities, attempts to gain new sources of information, or to improve one's own situation by setting up a bargaining position." Metcalfe (2002) shows us an example in which the demand-side is important in the co-evolution of an industry and of knowledge. I will come back to this case study in Part II.

[16] As Kelm paraphrases Schumpeter: "'in a stationary economy', i.e. in an economy *without* innovations, "'entrepreneurial profit would be *absent*'" (1997: 103f.; emphases added by Kelm).

[17] Schumpeter's later work is dedicated to processes that he already mentioned at the end of his 1928 article. In a so-called "trustified" capitalism innovations are projects planned by large companies. The role of the entrepreneur is diminishing. Instabilities of the economic system of a kind that the entrepreneur caused will be absent. Schumpeter goes as far as to predict the decline of capitalism. Although it is no less important for understanding the Schumpeterian logic of capitalist development, I will not follow this discussion in detail. The entrepreneur's role, characterised above, will be sufficient for the purpose of this work, which will deal mainly with micro and meso layers, whereas the investigation of the "trustified" economy refers rather to macro economic elements. Instead, where necessary I will refer punctually to the relevant parts of Schumpeter's late theory.

Schumpeter himself rejected explicitly analogies to biological evolutionary theories, many evolutionary economists interpret his work analogically to biological evolution (cf. for example Kelm 1997). Even Alfred Marshall – one of the founders of the neoclassical school – realised that the analogy to the physical-mechanical world, which can be seen as the traditional theory background of neoclassical general equilibrium theory, is not the most appropriate one. For him, a biological might be it:

> "'But biological conceptions are more complex than those of mechanics; a volume on Foundations must therefore give a relatively large place to mechanical analogies; and frequent use is made of the term 'equilibrium,' which suggests something of a statical analogy". (Alfred Marshall, quoted in Hodgson 2004: 14)

When Alfred Marshall, as early as in the 19th Century, spoke about the "Foundation" of an economic theory, he did not insist on having the duty to stick to such mechanical conceptions. More than one hundred years later, this model is facing so many difficulties – of which the entrepreneurial role is only one sort[18] – that probably even Marshall would think about an alternative one. Schumpeter himself neither followed the evolutionary biology analogy (Kelm 1997: 109), nor did he dedicate himself to the mechanical worldview, on which neoclassical theories rest. Rather, for him empirical and theoretical research of economic development should be done by historical studies (cf. Fagerberg 2003: 133).

So what are the evolutionary elements in Schumpeter's work? Why do so many evolutionary economists welcome his work, and recognise him as their main precursor? Though Schumpeter himself rejected the analogy to evolutionary biology, we can find hints to those analogies in several parts of his work:

> "The changes in the economic process brought about by innovation, together with all their effects, and the response to them by the economic system, we shall designate by the term Economic Evolution" (Schumpeter 1939a: 86).[19]

Or there are those passages in Schumpeter (1934: 254), paraphrased by Kelm (1997: 120): "'measure of selection' without which the economic system would be burdened 'with the unadapted and with those firms which are unfit to live'". Although Schumpeter did not make an effort to work out a proper analogical concept, and even refused to do so, he seemed to be committed, even if probably unconsciously, to the Darwinian world-view. In order to show processes of economical change, it may be useful for us to use biological evolution metaphorically (cf. van der Steen 1999: 20) here and there.[20]

[18] There is to mention, in the first place, the difficulties in including research findings of a whole Millennium in terms of human and social action. There are difficulties in the model's conjecture about the ontological status of the units of analysis, and much more. Further below, I will come back to those issues.

[19] Found in Fagerberg (2003: 129, footnote).

[20] Analogies to biology are an essential part of evolutionary thinking in cultural systems. Likewise, as with Schumpeter, questions arose about their ontological status. Newest approaches in evolutionary thinking abstract from such analogies and treat evolutionary processes as a general feature (Metcalfe 1998; Nelson 1995; Witt 1992). I will come back to this discussion.

Darwin's theory of natural selection has been seen for a long time as *one* root of cultural evolutionary thinking. Those individuals who are better adapted to their environment due to their (unique) properties have better chances to inherit these properties because they have a (statistically) better chance of survival. As properties in Darwin's scheme are not subject to change, but only pass away when their carriers, the organisms, die out, analogies to cultural evolution are difficult. Hence, the *other* basis of cultural evolutionary thinking is the theory of Jean Baptiste Lamarck. His concept of "the inheritance of acquired characters" is in many respects more suitable to cultural theories than Darwin's approach. It can cope with the social-cultural phenomenon of acquiring knowledge by learning.[21] In evolutionary economics, as well as in evolutionary biology, there can be found many different interpretations describing processes of change over time.[22]

However, the short outline above about Schumpeter's theories already contains many features of evolutionary thinking. His objection to equilibrium theories is a plea for evolutionary processes. The kind of economic system that Schumpeter suggests is evolving, rather than already existing as a ready-made setting. The very nature of capitalism is instability and change. New firms, established by entrepreneur's action, enter the capitalist market; they offer new services or products; they change production costs by using innovative production processes, and, hence, enlarge the existing market; they may even create new ones. The capitalist system is an emergent social phenomenon.[23] Whenever we speak about growth rates in the economy we speak about processes of emergence.

There is Schumpeter's remark that "the economic element in, or aspect of, social life might well be essentially passive and adaptive" (1928: 374). This is the conservative element of evolution. It is threatened by the entrepreneur's function. He faces ambitiously this passive and adaptive situation, when he introduces new products, new services, new production processes and other innovative organisational forms, and creates new markets. This can be interpreted as one main factor in evolutionary theories: creation of variety. Within this variation some of the novelties are selected

[21] Ernst Mayr describes the difference between Lamarckism and Darwinism as "transformation in time" on the one hand, and "transformation in space" on the other (1982: 401). This means that for Lamarck the environment has priority and species adapt over time according to the needs of environmental change. For Darwin, first, variation happens and selection follows afterwards (1982: 354). In this large book Mayr stresses in detail the controversies between and within both theories. Those, too, have often been subject of discussions in cultural, and hence in economic evolutionary theory. I do not want to go too much into detail, here. In the following section I will come back to some of the analogies.

[22] Furthermore, there are ways in evolutionary thinking that do not derive from Schumpeter's work. Hodgson, for example, in his institutional approach sees in Thorstein Veblen the main forerunner of evolutionary economics (Hodgson 2004). Van der Steen (1999) draws also the distinction between the Schumpeterian and Veblenean evolutionary strand. Unfortunately, there is not the space in this work to refer to the latter.

[23] The term *emergence* is subject of many discussions in evolutionary theories as well as in other academic debates such as in philosophy. There are, for example, questions about the consequences of the entry of new entities for a whole system (cf. Mayr 1982: 61f.). I do not follow this discussion in detail. However, emergence as property is a crucial issue of Schumpeter's economic theories as well as of evolutionary theories in general, and it will accompany us throughout this work.

by the economic system. It is indeed the market of supply and demand where novelty is evaluated whether it is adoptable or not (Metcalfe 1998: 27f.), which means whether it is successful, or in biological terms whether it is *fit*.[24] Imitators copy successful novelties, a process that may find its counterpart in evolutionary biology in the term *heredity*. Those novelties are facing a diffusion process, where they adapt to their economical environment. Rivalries force some novelties out of business; others survive but are not novel any more. They are copied in manifold ways and adapted into the economic process. Those successful novelties cause a transformation of its environment. Existing products, production processes, forms of organisation, services, firms and even markets are threatened by new ones and may disappear. This is the process of stabilisation of the economy after phases of innovative action (1928: 383f.). Later on Schumpeter named the whole process the "gale of creative destruction" (Schumpeter 1947).

Innovations as kind of variety are represented in Neo-Darwinian theories by genes that, when they are copied, differ in some cases due to random mutations. But such genes can also be associated with the carriers of innovations, such as firms or business units (Metcalfe 1998: 27), or even with whole markets. This depends on the unit of selection, which, on the other hand, depends on the unit of analysis and, hence, on the perspective of the researcher. The pool of those genes (organism or population in general) may represent a distribution in the market environment. At hoc analogies like these bear a lot of difficulties. Darwinian theory, just as one example, is built on random mutations, whereas a pool of innovations as a kind of variation is more or less directed. Another example is the notion of firm or business unit. Unlike genes those entities changes over time. Treating them analytically as genes one must consider whether these entities are sufficiently stable in every moment of the analysis, otherwise they cannot be used in the analogous meaning to genes. Discussions like this one are treated in the following section.

To sum up, Schumpeter's economic theory involves the following characteristics of evolutionary processes: Entrepreneurial innovations, i.e. new combinations of existing entities, constitute *variety* in an economic system. Among those innovations some are successful and will be adopted by the market system as well as by imitators: *selection*. The latter copy such innovations, which then adapt to the market: *heredity*. Products, production processes and services, firms as well as whole markets, they all are subject to change or even disappearance: transformation, *evolution* respectively (cf. van der Steen 1999: 21). The message for neoclassical economists is that the economic system is *not stable*; self-transforming processes drive its change; hence, changes to the capitalistic system are endogenous. *Unique* entrepreneurial action as novelty generation, or innovations, represents those self-

[24] A broader focus shows that the economic market is only *one* device to coordinate this process (cf. for example Metcalfe 2002). I will come back to this issue.

transforming phenomena and makes the status of a present system irreversible.[25] These arguments, raised against neoclassicism, were not really credited during Schumpeter's lifetime. According to Kelm, evolutionary thinking was not very popular at those times. The so-called neo-Darwinism, with its basis in Mendelian genetics, caused a revival of interests to the social sciences not before the second half of the 20th Century (cf. Kelm 1997: 110).

3 Post-Schumpeterian Evolutionary Economics

a) In the Realm of Darwin and Lamarck

In the year of Schumpeter's death Armen Alchian published a paper (1950) in which he suggested an investigation into economical outcome, under circumstances of "incomplete information and uncertain foresight" (1950: 211), *ex ante* rather than the incentive structure of economical agents *ex post*. By that he came to the view that "realized profits" rather than profit maximisation is the criterion that describes success in the market environment (1950: 213). In this view, it is sufficient just to be *relative efficient*: "First, success (survival) accompanies relative superiority; and second, it does not require proper motivation but may rather be the result of fortuitous circumstances." (Ibid.) Alchian was less concerned with the perspective of pushing novelties into the market system as Schumpeter was, but with the adaptational circumstances of the market – with the phenomenon "natural selection". His ambition was to reflect the theories and methods of the neo-Darwinian approaches of his time. The following quotation may show this: "The economic counterparts of genetic heredity, mutations, and natural selection are imitation, innovation, and positive profits." (1950: 220)

His characterisation of innovation as gene mutation refers to randomness of the creation of novelties, and to conditions where the entrepreneur is at the mercy of his environment. Nevertheless, some important insights of this article have become instructive for the further development of evolutionary economics. First, there is the method that Alchian suggested for investigating the economic system. Like in biology the description should focus on the distribution of economic data rather than on the quality of single entities – an approach that is now known as *population thinking* (Andersen 1996: 10). Here, the quality of a single entity looses its importance; it is only one case in a range of equal ones and all together they reflect a certain condition of a system.

Alchian's notion of success as survival leads away from the rationale of profit maximising to one that has been termed "satisficing" (cf. Fagerberg 2003: 28f.). In this view, economic behaviour is not altered in order to acquire the best outcome but

[25] Whether self-transformation is an imperative property of Darwinian evolution is not quite clear. Hodgson, rather defensively, relates to authorities of evolutionary thinking that do not explicitly demand it (1997: 137). For others (e.g. Witt 2002; Foster 2000. 317) it is an essential feature of evolutionary processes in general.

only when the outcome is not sufficient (cf. Fagerberg 2003. 144f.). This corresponds to Schumpeter's characterisation of conservative conditions. But in this view, not only the environment of the entrepreneur shows conservative tendencies but also the entrepreneur himself, or better the pre-entrepreneur. Witt assumes that two major reasons lead to the incentive to create novelty: "curiosity and dissatisfaction or fear" (1999: 26). The latter connotes conservatism. The incentive to innovate derives from dissatisfaction of given situations.

This is the cornerstone on which Nelson and Winter (1982) built their models of rule following behaviour. They focussed on firms' behaviour in terms of innovations rather than that of single entrepreneurs (cf. Fagerberg 2003: 145f.). Firms, according to Nelson and Winter, do follow certain rules or routines, respectively. This kind of economic action is the normality, and firms do not change their action carelessly. Those routines are the units of selection, and Nelson and Winter's units of analysis. When the firm's rather conservative disposition, i.e. "rule following", is disturbed due to threats from its environment, such routines will be subject to change. Change may happen in form of innovation of new routines or as imitation of routines used elsewhere. Hence, routines that are successful are transferred to competitors by imitation or are inherited within the firm. Whether a routine is successful is decided by its competitiveness on the market (or by "government procurement", van der Steen 1999: 22).

This focus is dedicated to the late Schumpeter rather than to his early work on the single entrepreneur. However, as with Mendelian genetics in biology the focus of analysis, shifted from organisms to genes, has been accompanied by micro-phenomena, Nelson and Winter offered an approach that applies firms' behavioural micro-structures in order to explain dynamics of the economic system. Furthermore, their appliance of routines as units of analysis refers to another keystone that implicitly accompanies all theorising in evolutionary economics: knowledge and the mechanism of heredity. Just as genes are the carrier of information that do not change during a lifetime but, when inherited, can mutate in isolated cases, routines are carrier of knowledge that are relatively stable (Kelm 1997: 111). But unlike the gene pool, routines and the structural component that they build, the firm, change significantly due to learning effects, or better: they are substituted by other routines. I have introduced Nelson and Winter's approach by characterising it as focussing on conservatism, i.e. change of routines are caused by a changing environment only. Now, by shifting the perspective and looking at the routine carrying firm as unit of selection, we get another picture. This firm is able to influence its behaviour as well as its surrounding conditions, i.e. the environment (by replacing routines). It is not just a subject to selection or non-selection like a routine is, which is selected or replaced by another one. The market plays a crucial but indirect role in the selection process (Metcalfe 1998: 28). It coordinates the evolutionary process by determining the competitiveness of products and services. As firms depend on competitive prod-

ucts or services they have to alter their routines when they are not competitive in order to be able to offer cheaper or better products or services.

At this point, employing the Lamarckian evolutionary process is more conducive, as the adoption of new knowledge by a firm and its adaptation corresponds with Lamarck's theory of the *inheritance of acquired characteristics* rather than with Darwinism. The possibility of rapid change within the lifetime of the firm is given whereas Darwinian evolution is seen as gradual (van der Steen 1999: 23).[26] Furthermore, the Darwinian insistence on random mutation is replaced by change due to purposeful action. The latter marks a further problem in analogising economics and biology. The actors themselves do have influence in the course of evolutionary process. Not only can they alter their rate of adaptability; they can alter the selection process itself. This effect is well known as *reflexivity* to the social sciences, for example in science studies (Woolgar 1988) or in sociology (Giddens 1991). Reflexivity is a certain kind of learning effect in which agents look back to the outcomes of earlier actions and draw conclusions for action in the future. In a radical manner this lead to a paradox for evolutionary theories. The following quote from Alex Rosenberg, a critic of evolutionary theories, shows what is meant: "If we knew environmental conditions, then we could state what optimal adaptation to them could be. And if we could do this so could at least some of the economic agents themselves." And further: "If rational maximizing is adequate as a theory, evolutionary rationales are superfluous, if it is not adequate, then an evolutionary approach is unlikely to be much better [than a neoclassical one, SH]" (Rosenberg 1992: 180).[27] Rosenberg, however, agrees with the evolutionary strand that knowledge about the environmental circumstances must be far from comprehensive, and it cannot be otherwise (ibid.). This makes the problem of reflexivity a mere theoretical one. But it leads to another issue that makes evolutionary economics differing from neo-Darwinian biology.

[26] To describe the difference between Darwinism and Lamarckism is not as simple as it seems to be in the first place. Crude comments about Lamarckian evolutionary processes state that, for example, the giraffe's neck is enlarging because it used to stretch it towards trees all the time. But Mayr's notion of *Lamarckian evolution in the timeline* (vertically) instead of the Darwinian location (horizontal) approach (see above, footnote 21) suggests slow evolution and gradualness, too. Mayr himself even praises Lamarck for "his emphasis on the gradualness of evolution" (1982: 359). However, as learning shows effects during the lifetime of an economic entity, the crude version of Lamarck fits even more to evolutionary economics. Btw., theories exist among evolutionary biologists that, likewise, call for stages of rapid change in biological evolution (cf. Mokyr 1990: 290).

[27] Yet, the potential of prediction is not absent. In Alchian's view the characterisation of the environment does well bear predictive power. It is able to describe the conditions not only of the past but for potentially future actions, too. However, Rosenberg missed the point of evolutionary thinking. It is not about the rationale of individuals but, if about any rationale whatsoever, then about the distribution of all kind of reasoning. Milton Friedman (1953) tried to use Alchian's argumentation in order to put forward the concept of rational maximising by insisting that evolution over time will lead cumulatively to maximising behaviour. One of the first critiques on this was raised by Sidney Winter (1962) who argued that in order to cumulatively improve individually you need a stable environment. But, as seen, the system is not in equilibrium. Hence, there is no reference point to find orientation. On more about this critique as well as other counterarguments to Friedman's theses cf. Blaug (1992: 99ff.) and Andersen (1996: 12f.).

A somewhat milder version of reflexivity is concerned with important micro-processes in the course of novelty creation. Although the activity is guided by reflexive and other kind of experience, the entrepreneur cannot foresee the outcome of his activity, nor the course it will go. That he yet steers for the direction he decided despite uncertainties makes him different to other economic actors. But neither his ideas nor his decisions are random in the sense of gene mutation. They are, firstly, directed towards profits.[28] The entrepreneurial realm taken for granted they are, secondly, rather "blind" than random, as Donald Campbell puts it (Campbell 1987b). This means that no variety happens from scratch but within a certain horizon; it is the mental and sensual horizon of the entrepreneur. The current state of his knowledge has to be taken into account. What follows is a process of trial and error, in which the agent is steadily learning during his activity.[29] Those activities do not show the characteristics of general rationality but of "bounded" rationality, or "procedural" rationality, as learning shows the characteristics of processes . Evolutionary economics, in order to cope with such kind of human conditioning, must take into account thought processes. Hence, not only on the aggregated level of the capitalist system does history matter but also at the micro level.

Concepts of rational thinking and motivational structures accompany us throughout this work, first in contrasting neoclassical and evolutionary analysis, now in the discussion about the value of analogies to biology. However, human intentionality is important in evolutionary economics and makes analogising more difficult. Alchian's ex post analysis does not depend on any of those conceptions because of his focus to the mere outcomes and to the environmental conditions of action. One further critique by Rosenberg concerns time: "[T]he environment must remain constant long enough so that those strategies more well adapted to it than others will have time to outcompete the less well adapted and to increase their frequency significantly enough to be noticed" (Rosenberg 1992: 177). The difficulty here is Alchian's analogy between *genetic heredity* and *imitation.* Firms' behaviour changes quickly, so it is difficult treating them as adequate for a selection process in the Darwinian sense.

Now, we have gathered several issues whose connections to Schumpeterian innovation studies are close, which, on the other hand, do not fit properly to evolu-

[28] Innovations cannot be random because they rely on purposeful action towards an outcome in the interest of the entrepreneur, as Schumpeter has shown. However, we could come close to randomness, or at least nearer, if we include inventions. And we may even reach randomness if we change our focus away from Schumpeterian innovations towards the emergence of imagination and language. I will come back to those phenomena.

[29] Evolutionary Economists refer often to Campbell in this respect. Employing other theories about creativity would be possible and in many cases probably even more useful. This counts even if they were not evolutionary in their own right like Campbell's. The latter's conception is usually not used as an evolutionary compound of evolutionary economics, anyway. For example, when evolutionists try to investigate imagery and decision-making (e.g. Witt 1999: 27) in concrete settings, Campbell's discovery does not concentrate on the future aspects that the notion of imagery inhibits, such as personal strategies. For those questions it might be instructive to employ Charles S. Pierce's notion of "abduction" as logic of knowledge production instead of blind variation. In Part III, I will give an example of abductive reasoning.

tionary processes as long as we see them closely to the realm of biology. The creation of economic novelty might be seen as combination of existing entities in new ways, just like gene mutations are defective copies of existing genes; but economic innovations do not happen randomly. Imitation in economics might have several similarities with heredity in biology; but in the timeline these phenomena are very different and not comparable at all, because learning effects lead to significant changes within a lifetime of an economic unit. The same counts for the process of reorganisation. Selection and survival of relatively fit entities happens within lifetime and not along generations of life. One is almost inclined to believe that Schumpeter had all these difficulties in mind when he rejected Darwinian evolution as an analogy. What was probably the bigger obstacle to Schumpeter was the fact that Darwinism cannot explain the endogenous emergence of novelty:

> "Darwinian theory is not concerned with endogenous change. It is concerned with equilibrium outcomes of unspecified competitive selection processes that are akin to disequilibrium dynamics, given some exogenous environmental shock that disturbs some ecological equilibrium.
> [..]
> Disequilibrium implies equilibrium and therefore, disequilibrating forces must come from without – should one come from within, then there can be no equilibrium – a nonequilibrium state must prevail. Schumpeter understood this and that is why a Darwinian analogy was not useful for his purpose." (Foster 2000: 320)

Lamarckian evolution is even more dedicated to exogenous forces. It is nothing but the changing environment that leads to changes in the characteristics of species in order to adapt to the new circumstances. There are more problems with the analogy to biology, for example the question about the essence of novelties. Shall we analogise such different entities like genes and organisms on the one hand, and products, routines, ideas on the other (cf. Witt 1992)?

However, the obstacles that are mentioned here occur on the economical micro or meso level rather than on the macro level. Whether similar analogical difficulties arise on macro as well, might be questioned. For example, if we choose another perspective and operate on macro-economical evolutionary processes, we may come close to variety consisting of randomly emerging entities. First, rationale and motivation of single actors is of no interest as long as it is not representative, because for a macro-economic view it has no analytical value.[30] Second, creation of novelty at the micro level is multifarious; in fact by increasing the rate of micro (from products to behaviour rules, further to language, further to expressions, further to ideation and imagination, etc.) this rate increases. The rate of *contingency* increases, too.[31] The

[30] Representativity in the evolutionary realm means not complete knowledge and profit-maximising behaviour but a distributional centre of a population of different knowledge positions and economical behaviour. This is population thinking. I will come back to this topic.

[31] Contingency means, in short, the possibility being different. Leaving aside necessity, i.e. determination, and impossibility it refers to potentiality or not-realisation, respectively (cf. Luhmann 1999: 152). We may even speak of *double contingency* or *social contingency*, when ego and alter encounter. For ego, alter is an alter ego; hence, despite alter is a black box for ego, ego knows that alter has different possibilities in mind just as ego has. Only with this double-contingent horizon ego can

amount of novelties and potential novelties ("it could have been otherwise") approaches an infinite rate. But only those that are facing a process of selection and imitation are of interest. This, however, is a step further in the process of evolution. Hence, in the realm of macro-phenomena the emergence of a single new activity may be seen as a random incidence, or it at least remains unspecified. For example population thinking as one major strand of evolutionary economics is not concerned with the emergence of single incidents.[32] Hence, not all evolutionary phenomena require explanation on all levels of analysis. In this respect some kind of evolutionary economics may be more capable to draw analogies to biology than others. However, watching for parallels to the biological counterpart seems to decrease.

b) Outgrowing Biology

Rather than looking for analogies to the biological sciences, recent approaches' starting point is a more abstract definition of evolutionary processes.[33] Such a broad view on the structure of processes as such does not work with analogies but can be related to numerous sciences that operate with changes over time, as Nelson put it: "It seems more fruitful to start with a general notion of evolution, and then examine applications in specific areas – like biology or economics – as special cases." (Nelson 1995: 54) Accordingly, Ulrich Witt offers a very broad characterisation when he proposes: "[E]volution can be defined as the self-transformation of an observed system over time" (Witt 1992: 406). This self-transformation process is well characterised by the activity of Schumpeter's entrepreneurial activity and its consequences to the economic system. Foster (2000) even argues that analogising research on the Schumpeterian entrepreneur with biology has caused a departure from Schumpeter himself, and that those alienated theories themselves are not up to date with newest biological findings.[34] Stan Metcalfe sums up recent evolutionary theories with a broad definition of the process of evolution; he mentions three principles:

> "the principle of variation, that members of a relevant population vary with respect to at least one characteristic with selective significance; the principle of heredity, that there exist copying mechanisms to ensure continuity over time in the form and behaviour of the entities in the population and the principle of selection, that the characteristics of some entities are better adapted to prevailing evolutionary pressures and consequently increase in relative significance compared to less adapted" (Metcalfe 1998: 22).

This definition does not pay attention to the phenomenon of bringing out novelty. In neo-Darwinian biology this happens randomly, and therefore needs no analytical attention. But as we have seen, in economics the very phenomenon of novelty crea-

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interpret, for example, a situation of non-action, because ego did expect a certain kind of action (cf. Luhmann 1999: 153ff).

[32] "[T]he population perspective does not require a theory of how variety is generated. It is sufficient to take variety as given and work through the consequences" (Metcalfe 1998: 24)

[33] Evolutionary biologist Ernst Mayr also argues that evolutionary thinking existed apart from Darwin and Lamarck, and before them, in cultural academia, e.g. during the French Enlightenment (1982: 322ff.).

[34] Those newer biological strands are concerned with the self-organisation principle on the level of genes. Foster is actually not strictly dedicated to biology, but he argues that findings about principles of evolution should not be ignored, as they may useful in other disciplines as well.

tion is important and far from random. This might be one of the reasons why Metcalfe pays attention to a more precise definition that he borrows from Endler and McLellan (1988), which define five stages of evolution:[35]

> "• processes which generate variation in the pool of characteristics in the population by adding or subtracting competing entities or by altering the characteristics of existing entities;
> • processes which restrict and guide the possible patterns of variation in behaviours;
> • processes which change the relative frequency of different entities within the population;
> • processes which determine the rate at which the above three processes regulate change; and,
> • processes which determine the overall direction of evolutionary change." (Metcalfe 1998: 23)

The first stage is concerned with the creation of novelty. However, with his focus on population studies Metcalfe himself is not concerned with the process of generation of variation.[36] In population thinking attention to the individual is paid only statistically.[37] A population is shaped of individual entities that are under the same kind of pressure, i.e. share the same selection forces (Metcalfe 1998: 24ff.). The task of population analysis is to investigate the distributional frequency of entities and patterns of change of this distribution over time. In order to shape a population in which selection takes place, the notion of local and bounded knowledge and dissimilarity of motivations is crucial. As Metcalfe puts it:

> "Clearly the members must share some attributes in common but they must also be different enough for selection to be possible. Evolutionary populations cannot be based on identical entities." (1998: 26)

In the realm of economics such entities might be the routines such like those of Nelson and Winter. Whole firms as carrier of routines can, likewise, be defined as units of selection. But this unit is in some respects to broad to meet the needs in order to investigate innovation processes. The firm is competitive or uncompetitive not only due to its innovative capabilities but also due to other capabilities such as their capabilities on the stock market, etc. Therefore, in order to investigate the development of industries, Metcalfe suggests a "set of routines to guide behaviour, routines which collectively constitute the knowledge base of the particular activity" (1998: 27). Those routines produce a certain output that competes on a market. Hence, as mentioned above, those routines are only indirectly subject to selection. Competitive in terms of economic behaviour is a business unit as actor (with abstraction from the behaviours that are not in question, cf. above).

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[35] Metcalfe's framework evolution is a cyclical process. Novelty is induced by a mechanism of feedback to former selections: "[..] feedback from the selection process to endogenize partially the regeneration of variety" (1998: 98). In fact this is the learning mechanism described above. But how can this explain Witt's first of the two motivation patterns creating novelty: curiosity? (Cf. Witt 1999: 26)

[36] Cf. footnote 32.

[37] Ernst Mayr, who propagates this kind of investigation for biology, asserts: "Population thinkers stress the uniqueness of everything in the organic world." (1982: 46) It is this uniqueness that makes population thinking differ from "typological thinking". Typical, or better: representative, is not the entity itself but rather the median value of a distribution shaped by differing entities. This makes each entity unique and subject for descriptive statistics.

Like with Alchian, fitness of a business unit within a population of rivals does not mean to be the most effective unit in the population. To survive a unit needs only be satisficingly fit. It is an empirical question at what rate a unit is not competitive (1998: 44), and this rate differs in various market environments. The market, in its selective function sends signals to actors about available routines and their success, and serves in this sense as coordination device. According to Metcalfe, like the coordination of supply and demand despite uncoordinated looking individual action, the market as *invisible hand* (Adam Smith) coordinates the routines that are used or changed, whether other routines are imitated or new ones created. The market is, in this function, a carrier of information. This feature is important as it implicates that selection as competitive process reduces variety in the first place. Behaviour adjusts to those routines that lead to the best economic outcome. The differences of behaviour diminish as the differing routines gravitate to the best adapted. But since routines are not only subject of imitation and copying that leads to this gravitation, but innovations of new routines happens also, this gravitation is disturbed permanently. So, just as in neoclassical theory stability is represented by equilibrium, in population models stability is represented by the state of average of behaviour (1998: 95). Likewise, the rate of dynamics of the population depends on the pattern distribution of different behaviour. If each individual behaved equally, we would have no dynamics (ibid.). Now, coming back full circle to Schumpeter's differentiation between system and order, in capitalism the stability of the system may be disturbed continuously but order, represented by the coordination function of the market, remains stable.[38]

In order to analyse the micro elements of evolution, and to investigate the source of novelties, it is necessary to change to another aggregative level of evolution. Evolutionary economists refer often to psychology or socio-biology like, for example, processes of learning under uncertain conditions (Campbell 1987b) or Witt's investigation of entrepreneur's motivation structures (1992). Socio-biological frameworks suggest that like individual's motivation and knowledge is not unique, neither is human precondition to acquire knowledge. Kurt Dopfer (2004), for example, looks at the very basics of human nature in order to prove that man is physically endowed with the ability to bring in novelty. This ability is given by the capability of imagination. The human species is able to look ahead. It is able to imagine a future. But unlike with *Homo Oeconomicus* whose rational precondition is stable, this ability is subject to change over time, i.e. to development, and so is the ability to behave rationally (2004: 189). Dopfer asks now for a research scheme that investigates this development in within an evolutionary scheme of rule creating and using, which would describe the *"Homo Sapiens Oeconomicus"*.

[38] "The dynamics of capitalism require co-ordination; they do not require equilibrium." (Metcalfe 1998: 95)

This is an ambitious task, however, in his view it would contribute to the full picture of human evolutionary economics. But this picture would nevertheless be incomplete if we refer from human preconditions of rational thinking strait ahead to rules used by business units. There is one important phenomenon that is, likewise, subject to evolutionary change and which cannot be separated from the evolution of cognition: communication. Cognition is a physical and at the same time a social phenomenon. The distribution of neurons within the cortex may be the initial precondition for cognition. But this is not meaning. And meaning, in order to be noticed as meaning, needs society. Wittgenstein's private language argument (Wittgenstein 1953) shows that we are not able to produce meaning without a reference point external from us. Being in a mental state without being involved in social life would mean not being able to acquire knowledge. Imagining a private language that makes sense only for me is impossible. I have no means to see whether the new sensation about "S" has the same meaning than yesterday's sensation about "S" (1953: Paragraph 258). With a reference point outside me I would be able to check this. But this is a social phenomenon and must be communicated. Dopfer, however, leaves a gap of evolution when he refers from the novelty generation capabilities of *Homo Sapiens Oeconomicus* straight away to rules that are used by firms. Among others, particularly Wittgenstein's *Philosophical Investigations* changed the way of thinking concerning consciousness.[39] Ignoring the "linguistic turn" of philosophy would be a step backward to the early 20th Century. The missing link we need to take into account is the most basic phenomenon in societal evolution: *communication* (Luhmann 1997).[40]

Schumpeter's work is not without critique in evolutionary economics. Witt, for example, is not as convinced as Schumpeter was that change by entrepreneurial action is really endogenous. According to him, at current state we do simply not know enough about the process of knowledge production and motivational disposition of economic actors:

> "An explanation of how new knowledge is created, and what the feedback relationships between search, discovery, experimentation, and adoption of new possibilities look like, and the respective motivations – all this would be necessary in order to really be able to treat economic change as being endogenously caused." (Witt 2002: 15)

Witt also criticises that Schumpeter has underestimated the creativity of other economical actors such as consumers.[41] Thus, the question of endogenous or exogenous change might be fight on another level.[42] It seems at first sight that newer strands of

[39] In fact contributions like those by Wittgenstein changed the way of epistemological thinking. Taking this epistemological standpoint would mean that inventions, and then of course innovations, are genuine social endeavours.

[40] In Part III, I will discuss briefly some possible implementations of this kind of evolution into the framework of evolutionary economics.

[41] Cf. footnote 15 on page 14.

[42] In social science there exists only one theory that I know that postulates strictly closed systems. This is the *systems theory* by Niklas Luhmann (1997; 1999). But there is a high price to pay: The systems consist only of communication. Human action and even human consciousness is to be seen as environment. This makes the theory very abstract and, because of this high level of abstraction,

evolutionary economics that operate rather non-reductionistically (cf. Hodgson and Knudsen 2004: 283) may have undermined Schumpeter's conception of endogenous change. Entrepreneurial activity is closely connected to other societal realms and not completely separate able. However, Schumpeter's main contribution, the theory capitalist development, is not threatened at all by those objections.[43] It is rather a matter of micro perspective that makes some more detailed characterisations of entrepreneur's activity necessary. But this does not cause implications to change Schumpeter's whole theory, like the latter does with respect to neoclassical economics.

To sum up Part I, we have worked out many economical features, which are in contradiction to the neoclassical position, and which can, especially with respect to the rapid acceleration of economic change due to technology, neither be neglected, nor be treated as mere auxiliary assumption. The first we have seen is that in the capitalistic economic system ongoing change is its very nature. Even if history has shown stages of less movements – when the rate of innovations was correspondingly low –, change is never absent as long as the growth of knowledge will not stop. The role of the entrepreneur's action as carrier of knowledge with certain motivational characteristics – as a firm or an organisation, whatever – is the crucial factor since the entrepreneur stimulates system's change by introducing its fuel: innovations. As ideas differ with each moment in history, and the system's changes never start from scratch, but build certain paths, history matters; a system's state is irreversible. Likewise, the individual matters. Rather than sharing general characteristics such as full knowledge of the market and profit maximising motivations, economic actors and economic actions differ significantly, depending on their own history, their environment, etc. Otherwise, innovations would not happen. The mere expression of variety forbids talking about general theoretical assumptions, and makes it difficult to think in ideal-types. The system may change but, nevertheless, within capitalism it is highly ordered. The market as institution of coordination reflects this order.

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in a certain kind too simplistic to be well usable in empirical research. It is, likewise an expression by Luhmann, not capable of connection ("anschlussfähig") to other existing social theories.

[43] By raising critiques at this point, we would, again, entry a philosophical realm. A strict interpretation of Schumpeter's work about the process of trustified capitalism, in which it ends in socialism, would Schumpeter classify as teleologist. "Evolutionary theories can only claim that certain developments or consequences will not occur – and empirically testable conjecture." (Witt 2002: 17) I am not sure whether evolutionary economics must be that modest in predictions. Predictability might be rather restricted, and Schumpeter made an ambitious prediction, no question on that. But what might be teleologism on one perspective might well fit into an evolutionary framework of another, e.g. a perspective of centuries or even millennia. If we use Witt's statement "only claim that certain developments or consequences will not occur" [$\neg\mathbf{x}$], and argue with Schumpeter that trustified capitalism is not to proceed, we only need to replace x with *the proceedence of capitalism*, and have no conceptional contradiction, but if so then only an empirical one. Hence, Schumpeter might not have argued teleologically but was probably too keen according to his data, only. This sounds like a polemic, but it is not. If we assume that his perspective was simply another one than that of Witt – seeing capitalism, socialism, maybe feudalism etc. as variation among which an evolutionary process will select –, the statement that capitalism keeps on going is as speculative as Schumpeter's insistence that it will decline. This example may show how important it is to define the unit of selection, while speaking of evolutionary theory.

Neoclassical theories are not well prepared to deal with an economic world-view shown above. Schumpeter's outline of the dynamic development of capitalism has been implemented into the theory of evolutionary processes that stays in contrast to neoclassical theories in many respects. Evolutionary economists have been developing alternative ways to investigate the economical process. They have produced remarkable knowledge about economic action that is important not least for policy makers. One well-known topic is the investigation of "lock-in" effects and path dependency (David 1985; Arthur 1989) that may help to set up the right economic order with respect to legal treatments of monopolising tendencies. So does Metcalfe's insistence that only heterogeneous behaviour in a selection environment leads to development. The latter is also a plea for heterogeneity in production of new knowledge, a claim that refers to discussions about the role of scientific systems in society. The abandonment of complete information and of a single scheme of motivation may lead to more sophisticated incentive policies such as laws in taxation or in the realm of social security. It is not to say that equilibrium analysis should be abandoned completely. In many questions about markets it may well be the right tool of analysis, e.g. certain questions about a market of saturation where competition is nearly perfect (at the moment the market of DVD-Players). But a theory that fails to take history into account cannot be the grand scheme of economic thinking.

I have only briefly outlined evolutionary thinking and gave some hints to the empirical methods that are involved. Schumpeter himself was most interested in historical case studies; Nelson and Winter initiated the usage of models; Metcalfe propagates the analysis of populations; studies about entrepreneur's motivation and knowledge structures have been doing. In Part III, I will discuss the potential of further empirical tools. As by many evolutionary theorists argued, empirical research as well as theories from different social sciences may be welcomed to find appropriate means to investigate the dynamics of the economic system. In order to clear the ground for the discussion at the end of Part III, which deals with the potential of the usage of sociological frameworks, and of the *Socials Worlds Perspective* in particular, Part II will give an introduction to the latter, which shares many features of evolutionary thinking, and stays, similarly, in opposition to static world-views that dominated most of the 20th Century's sociological thinking.

Part II: Social World Perspective

Talcott Parsons' structure-functional theories, the main influential sociology in many decades of the 20th Century, do not address, similarly to neoclassical economics, the dynamics of social processes sufficiently. When looking at the structures of social life more precisely, the diversity as well as the dynamics of structures cannot be overseen. From such a micro perspective, structure-functional sociology appears to be rather naïve. Deriving from pragmatism, the micro-sociological *symbolic interactionism* has been in strong opposition to structure-functionalism. This is the basis on which the *social world* approach is originated. Like the micro-perspective research agendas of the so-called Chicago School, which is the home location of most symbolic interactionists, the social world approach takes humans' uniqueness into account. Evolutionary thinking highly welcomes such contribution, as it has to substitute homo oeconomicus as rational and well-informed profit maximiser. Unlike most of the interactionists, on the other hand, the social world theory addresses also larger aggregations of sociality. This is what may increase its potential value for evolutionary theorising, and where both share many theoretical elements.

1 The Basic Conception

We have seen that psychological conjectures have a certain standing in evolutionary economics because they shall describe individual's activity as it really is, not as he ought to be in order to fit into an analytical framework. Symbolic interactionism, at its basis, is a social psychological approach. Its focus is not so much the isolated individual – which is often the case in psychological approaches – but describable elements that are shown when the individual is part of a group. One of the major figures in symbolic interactionism, Herbert Blumer, puts it as follows:

> The first premise is that human beings act toward things on the basis of the meanings that things have for them [..]. The second premise is that the meaning of such things is derived from, or rises out of, the social interaction that one has with one's fellows. The third premise is that these meanings are handled in, and modified through, an interpretative process used by the person in dealing with the things he encounters. (Blumer 1969: 2)

Studies in symbolic interactionism are generally focussed on interaction and sense-making in small groups. Case studies are the vehicle to express this kind of research. However, the social words approach, although positioned in this realm, is concerned not only with small groups but offers a general framework for investigating interaction, even of larger aggregates. In this respect the social world approach is a bottom up framework that does nothing say about how humans are supposed to behave but how they do in reality. Groups reflecting certain social structures, but such structures depend on the individual in reverse. By changing the individuals' dispositions, or the group's mere population, the structure of the group changes, too. This is a first connection with our evolutionary framework.

One of the earliest contributions to the social world approach was the investigation of medical professions with respect to their real workflow rather than to their setting as an organisation within public service. Bucher and Strauss (1961) observed that the professions in radiology and pathology shaped a very heterogeneous and dynamic realm, but are connected nevertheless. The main field was primarily concerned with diagnosis. But a growing realm, because the technology of radiation made it possible, was concerned with developing therapeutic devices. These tasks have been becoming so different that organisational splits have happened, e.g. different training programs. Furthermore, a speciation of medical services grew out of these technological possibilities. This led to heterogeneous identification of medicals with their profession as well as to very different tasks in the field of pathology. Some did mainly medical research on disease; others contributed rather more to University teaching; a third group was concerned with the implementation of the new technology; and another group was doing mainly diagnosis, the reason for which those instruments where developed in the first place. The whole realm of pathology was changing dramatically. For those whose "core" (1961: 328) was constituted by research, the importance of doctor-patient relationship was declining; others were largely concerned with the scientific world of physics, were rather becoming engineers. It was clear for Bucher and Strauss that such heterogeneity cannot be seen as one single profession of pathology, but "as a loose amalgamation of segments which are in movement" (1961: 333). Those segments differ in ideology: "there are many identities, many values and many interests" (1961: 326).

Later on, Strauss presented a conceptualisation of such amalgamations of segments and called them "Social Worlds" (1978; 1982; 1984). Social worlds are often part of institutionalised organisations, but they do not reflect those structurally. Furthermore, they are not limited to organisations. What defines a social world in the first place is "at least one primary activity" (1978: 122) – in the example above pathology as the profession concerning disease. Primary activity is not always a well-defined social phenomenon. It comes nearest to Everett Hughes notion of "going concern" (1971). This describes rather a phenomenon than is crosscut to institutionalised organisations. In the words of Clarke (1991: 131) social worlds are "groups with shared commitments to certain activities, sharing resources of many kinds to achieve their goals, and building shared ideologies about how to go about their business".

Such worlds intersect to other worlds from which they borrow technological expertise, or services etc. (radiology in the example above). Sub-processes like those of the pathologists may shape the segments of teaching, healing, technology, theory, or administration, and build subworlds (Strauss 1978: 123). As the social world approach should be seen as a perspective rather than a theory about social entities, we could shift to another perspective, e.g. to the social world of technology. We would find a completely other setting with different subworlds, and different intersecting

worlds.[44] Members of social worlds are more or less dedicated to core activities, hence, their dedication to, and representation of, the world differs within the continuum between loose and tight. Furthermore, members may act individually, "but in arenas they commonly act as representatives of their social worlds" (Clarke 1991: 132). This is a powerful analytical step as it allows abstracting from the individual to the action of a group.

A social world faces ongoing processes of intersecting and segmenting, but also processes e.g. of access and leaving by new members (Strauss 1978: 124), or of legitimating itself by "[d]iscovering and claiming worth"; "[d]istancing"; "[t]heorizing"; "[s]tandard setting, embodying, evaluating"; "[b]oundary setting, and boundary challenging in arenas" (Strauss 1982: 173). The social world is built on order like any type of institution. This kind of order, however, does not base on well-defined rules like in institutionalised organisations, but on negotiated agreement. Therefore, a social world can have a rather fugitive character and may show a tendency to change rather quickly. Once core activities are established, actors are bounded to those not only by routines and rules, even if there are rules of thumb, but they are morally committed to them.[45] This is an important insight. It would open up a different topic of research in the field of entrepreneurship. Members of an entrepreneurial social world are built not least on certain self-images. They share a mutual identity. But as the social world is in flux, so is its members' identity. This is a development in its own right.

We can see some resemblances to the evolutionary realm treated in Part I. Social worlds themselves are emerging phenomena. They can exist a very long time, or can disappear after a short while. Within a social world, change on a daily basis happens, concerning membership, position within the world, shift of the mutual endeavour, etc. The notion of *going concern* does not reflect any typical action that would represent the social world. It is rather a bunch of different activities from different individuals with different motivations, etc. These are more or less dedicated to the mutual project. The challenge of evolutionary economics towards neoclassical theories is very similar to interactionists' critique on Parsons, concerning the static setup of the latter's functional systems theory. Symbolic interactionism was facing the structural concepts of Parsons throughout the 20th Century. *Structure* in Parsons conception is a-historical. It is closely connected to works of the anthropologists Ruth Benedict and Margaret Mead, whose notion of structure relies on research of locally separated native groups. They themselves, just as Parsons, have not raised questions about the emergence of structures (Tenbruck 1990: 39).

[44] In a social world of radiation technology, for example, would radiologists as medical-engineers shape a subworld that dedicate the technology rather than pathology.
[45] "[..] commitments of individual actors to collective action" (Clarke 1991: 129).

2 Co-Evolution of Knowledge and Industry

Evolutionary economists insist on the importance of knowledge in an evolutionary capitalistic process, its potential to induce development of industries. But it is not only knowledge that serves to increase industries; this relation is "double-sided" (Metcalfe 2002: 14). Economic incentives and industrial R&D lead to the growth of knowledge, too: "Change the working of market processes and you change the way practical knowledge is accumulated" (2002: 9). Stan Metcalfe shows this relation with employing an example of the development of the industry and services in the realm of intra-ocular lenses (IOL, cf. 2002: 12ff.). A competitive process has led to a set of coordination between firms, hospitals, universities and research institutes. The particular form of coordination as well as of the product itself and of services around it has been shaped to a great extent by market forces. This means that the competitive process between a few large companies induced R&D activities and business relations in order to improve materials and services. Those innovations, on the other hand, contributed to the growth of knowledge in the ocular sciences.

This outline shows an example of co-evolution of an industry on the one hand, and of scientific progress on the other, shaped by innovative action and knowledge accumulation. Metcalfe insists on the importance of the interaction of the very different actors that, as we may call it now, are members of a social world or of a social arena, respectively. Even the market, in its ordering function as seen in Part I, is only one form of co-ordination, or as Metcalfe (2002: 8) puts it drastically: "It is surely somewhat shocking that the detailed understanding of markets and their formation plays so little role in the modern theory of growth of any persuasion." To investigate the emergence and growth of an industry within a macroeconomic framework would mean to hide important coordination processes in a knowledge economy.[46] According to Metcalfe a dialogue with social sciences is necessary in order to overcome those obstacles. I will meet this invitation with a short outline of Adele Clarke's social world-study (1990; 1998) about the emergence and development of the reproductive sciences in the US. It is basically constituted as a science study, but it nevertheless may serve to show the connection between knowledge and market forces.

Many different actors took part in the emergence and development of the reproductive sciences in the US. First there were three rather segregated sciences, namely agricultural, biological, and medical science (1998: 24ff.). These intersected in order to share their knowledge resources. This intersection was rather harmonious, as the field of investigation was very new, scientists in each field relatively autonomous in their decisions, and the scope of the sciences different enough not to have negative effects to each other (e.g. to the scientific world-view of each): e.g. analytical investigation of fertilisation in biology, infertility of humans in medicine, and improve-

[46] For insistence on plural forms of coordination despite similar market settings, cf. Bradach and Eccles (1989).

ment of reproductive capacity of domestic organisms by agricultural sciences. Hence, the core activities were still different enough to shape own social worlds. From the turn of the century onwards, the "audience"[47] that could have interests in these sciences started growing because

> "this period were those of industrialization – rationalization, professionalization, specialization, and technical development in terms of proving market value and effectiveness. The professions consolidated as market-based occupations [..]. Universities were transformed into knowledge-production industries or corporations [..]." (1990: 29)

According to Clarke (1990: 28f.), concerning the cognitive preconditions at the time, the production of knowledge about reproduction could have been starting to grow earlier, but such attempts were heavily restricted by law and by the society in general. Those developments, accompanied with social movements concerning birth control, eugenics and neo-Malthusian strands, shaped a certain demand structure that sooner or later would overcome restrictions and shape new markets.[48]

In the 1920s another incident happened. The core activity of the three sciences in question shifted because the research focus shifted from physiological analysis to biochemical processes due to improvements in scientific knowledge. Endocrinology became the new central task, from then onwards for each of the three sciences. This shift encouraged entrepreneurial action in the whole realm of reproduction. Research was relatively cheap (Clarke 1998: 86); existing audience, such as the social movements, was just waiting for products; new audience emerged as potential customer, as products in form of easy using drugs and pills were introduced (probably best known: the contraceptive pill). Scientific problems must be "doable" (Fujimura 1987), a term that aptly describes the connectedness of science to society.[49] The conditions in which social worlds are operating are important. They determine partly what is scientifically doable. For example, in the period between 1910 and 1925 the branch of embryology was lacking support in order to do proper research. What was their disadvantage was for the benefit of other branches such as genetics and reproductive sciences (Clarke 1998: 87f.). Hence, social worlds have to challenge their own position by legitimising themselves within a social arena of many kinds of competition (Strauss 1982). But doable problems are created as well. The new possibilities in research led to new scientific problems. The amount of life science departments at Berkeley, for example, has risen "from a handful [..] in 1890 to 17 in 1985" (Clarke 1991: 143). However, by the time she wrote that essay there were only two departments left.

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[47] "[F]or every discipline, the other scientific and nonscientific worlds with which it interacts are a set of audiences (the original term) which attend to its work, make use of its results, and provide it with findings, materials, equipment, raw data, and money [..]. Each audience hold unique expectations of a discipline, makes a different pattern of demands upon its research, and offers a different pattern and amount of resources in return." (Clarke and Gerson 1990: 191)

[48] Which may be defined in an Schumpeterian manner as expectational framework for entrepreneurs.

[49] One may think of the many unsolved scientific questions in astronomy or particle physics that cannot be solved because the financial resource is not available, for example the problems that could have been solved with the once planned but not realised super-collider in the USA.

Clarke sums up the emergence and development of arenas such as industries in three stages (ibid.): the "emergence era" in which negotiation is one key process-factor; the "coalescence era" which is characterised by "adding on"; the mature era in which reorganisation is the main process. This is a remarkable evolutionary summarise of her historical case study and at the same time a statement that commits the social world approach to evolutionary thinking. During the first stage, negotiation took place when the whole realm was promising outstanding outcomes. This phase can be compared with the early phase of entrepreneurship. Negotiations as prime task may reflect the uncertainty that derives from the mere novel character of the field. This notion of negotiation can be useful for research on the entrepreneur. Strauss distinguishes between *routine* (inter)action and *problematic* (inter)action. The latter, which is the common form in this first stage of development, involves a some kind higher degree of thought if it is about action, and/or debates and discussion if it is about interaction (Strauss 1993: 43). We see how interactionism can complement the discussion about Schumpeter's entrepreneurial function. In Part I our focus was lying on isolated individual action. Accordingly, in situations of uncertainty the demand for a higher degree of thought was postulated. The social world approach draws attention on negotiations in non-routine interactions. It adds to the entrepreneur's demand of proper thought, Schumpeter was asking for, the demand to negotiate. This phenomenon might suffer a bit of neglecting in evolutionary economics, and could be a focus of research in this realm.

Just when first successes had happened in the life sciences (novelties were adopted by the market), a process of imitation started, and led to a spreading of new products and, hence, to further diversification ("coalescence era"). The then following mature phase of rearranging reflects the adaptation process where further selections lead to the reduction of variety. Clarke asserts that the success of endocrinology as core activity of reproductive sciences was not predetermined but "[d]evelopments could have been otherwise or emphases different" (1990: 27). Notice this insistence on contingency that is, likewise, a characteristic of evolution.[50] Clarke also clarifies how to deal with this phenomenon: "Interactionists assume that things could have been otherwise and try to examine especially consequential moments, turning points, trajectories and careers (of concepts, people, technologies). History matters." (1998: 17) What is different in this approach, and may be subject of considering for evolutionary theorists, is the absence of the notion *environment* or even the notion of context. It suggests that the surroundings of the unit of investigation – a social world and/or arena – are worlds and arenas, too. In this view, the "environment" is not assumed to be stable, but in flux, just like the unit itself is. To classify the selection environment in this way could give some insights about its characteristics and dynamics and could be a different perspective in order to specify the conditions of selection.

[50] Cf. footnote 31 on page 22.

This short outline may have shown the useful impetus of the social world perspective to innovation studies in economics. Clarke's historical perspective on fairly large aggregates of action ended up, one might say: just automatically, with the description of an evolutionary process. It meets perfectly the notion of self-transformation of the (open) capitalist system. In her investigation of knowledge producing systems in the realm of science studies with non-reductionistic ambitions, Clarke discovers multifarious connections to other areas of society in which economical questions are not the least important ones. Likewise, a non-reductionistic economic theory that does not avoid going beyond its own realm would end up in mechanisms of cooperation in capitalism that are not solely market driven.[51] In science studies the focus on *doablility* of scientific problems proves to be a neat solution in order to connect the institutional knowledge production with other societal realms. There are other theoretical frameworks that investigate the interrelation between science and other social fields. For example Gibbons et al. (1995) call this kind of collaboration *Mode 2 knowledge production*. This approach, however, is a genuine institutional one and does not refer to actors as individuals. Symbolic interactionism, on the other hand, is based of individual human action; it is, so to speak, a bottom up approach in which the aggregate level reflects an abstraction of individual action. To show this, and the usefulness for evolutionary economics, we might change the aggregate level and take a look into a single firm.

3 Social Worlds and Individual Actors

Up to now, we have recognised social acts like commitment, negotiation, boundary-setting, legitimising, etc. only as abstractions. These, of course, are observable as genuine activities by humans, too. The social world perspective is focussed, as seen above, on mutual concerns and commitments. How powerful in terms of commitment the phenomenon *going concern* can be will be illustrated in a short insight into a firm that has launched (constructed, commercialised, and – in relation to a subsidiary company – built) innovative products related with power producing turbines, which are installed in river-dams. The process of launching was not always straightforward. First of all, there happened no innovation for nearly 20 years. Only a few turbines of old style were constructed at those times, as the main owner's actual activity was consulting with GTZ, a society that is concerned with global diffusion of technology.

When Mr. M., to whom I am grateful that he gave me the following insights, came to the company as design engineer, he carried a high degree of knowledge about turbines that he had obtained during his study as engineer and during his work-time for RWE, one of the main power suppliers in Germany. He started sim-

[51] Elsewhere, I have investigated the development of non-reductionism in science studies during the 20th Century (Hauptmann 2003). For a classification into four models with different degrees of reductionism, cf. Callon (1995).

plifying and rebuilding turbines in a way that they are now smaller and maintenance-free. Due to the small size of these new turbines, it is possible to generate power on places where it was not before – with the old-style turbines. Hence, the potential market for turbines has expanded. He had the possibility to do so as the technology went forward. New computer programmes have served him in order to construct a turbine of new style within several weeks.[52] After a phase of reconstruction of the existing turbines and the other measurements for that Mr. M. was the major contributor, he was offered an executive post in terms of technology (1:44)[53]. The son-in-law of one of the company's owners who was one of the executives, but not trained in the subject of turbine construction, protested against this because he would have lost authority. He then intimidated the shareholders that he would quit his job as executive. His father-in-law was not impressed by this threat and did let him go. Here, we get a hint of how strong ties can become due to a mutual endeavour, a *going concern*.[54] After only a short time Mr. M. was indispensable. The firm was ready to expand its possibilities in this sector of business. For doing that it has had to go beyond the obvious negotiation structures. Strong personal ties has become subject to question. We can imagine that in a firm in the same position but not as ready for expansion as our firm in question, a decision would have been different.

Our firm expanded further. By buying shares of a company in Dresden (1:32) it founded a subsidiary company that should build the planned turbines. With other reorganisation measures, such as standardising turbine-specifics (1:40) and replacement parts, it has reduced its cost and time of planning and construction as well as entered a new market (i.e. spare-parts for ship-kettles and water-cleaning devices as the subsidiary company was concerned with these businesses beforehand and had got many –unused – blueprints about this, 1:35). Success was vast, and, hence, Mr. M. was offered a partnership on the firm (1:52). Production of novelty at this firm has not stopped yet. The new project involves a completely new turbine style that is to serve a completely new market (cf. Part III).

Metcalfe asks how ideas come into the economic world. As Schumpeter has shown, it is not the inventor who contributes to economic growth, but the entrepreneur; and it is not the capitalist (owner of the firm) or the manager (his son-in-law) that can expand the possibilities of a company but, again, entrepreneurial activity.

[52] His companion is still working with DOS-systems.

[53] The numbers in the bracket show the position of the interview-segment. In this example, it is the 44th segment of the interview.

[54] This resignation could have had other reasons, of course. But the following quote may support the interpretation that I gave – that the mutual endeavour was decisive: "And after 1,5 years, after I have changed the way of constructing - I must say now, that his son-in-law was executive but he was trained in office-machine technology and has had actually nothing to do with this business; he was just the son-in-law –, then I was to become executive, technical executive because the dimensions of the business has been increasing […]. He was to make the sale and organisational part of executive […]. Then he did boycott. / question by the interviewer: lost of power? / Exactly. And then, his own father-in-law said: 'No this must be pushed through'. The companions voted likewise for this decision. And then, he has resigned, wanted to put pressure on them. So, they let him go." (Mr. M. 1:44, translation by SH)

Hence, we must think of a combination between new ideas and incentives that lead to business-models for expansions. With the social world approach Schumpeter's entrepreneurial function can be investigated in more detail. For, we can see a graduation in the kind of entrepreneurial action. When we adopt the *going concern* perspective, i.e. in analysing the process of introducing the new kind of turbine within this firm, we can indeed confirm Schumpeter's insistence on the different roles. We have, on the one hand, the team of engineers, working on routine-based grounds, i.e. changing the size of the turbines in order to fit them into their concrete-form, or changing the surrounding connections of grease utilities for the turbine. The partners mainly incorporate the role of the capitalists. They bear the risk and raise the money. Mr. M., as one of the partners, incorporates both the role as capitalist and as entrepreneur. It was his technological idea as well as his economic initiative that has led to the growing market share of the company.

This is also a question of personal qualities, just as Schumpeter was demanding. When Mr. M. was working for RWE, he was not very pleased with the job because he was only concerned with maintenance engineering. His orientation was always directed towards creating something new: "I was boring with RWE because there has no longer been done anything new" (Mr. M. 1:3; translation by SH). Furthermore, Mr. M. incorporates not only inventory capabilities but also business sense. It was his idea to use the old blueprints of the subsidiary company, to digitalise them and to offer standardised spare-parts in this realm (1:35).

A Question that was also addressed by Schumpeter was the tendency of resistance. Mr. M. himself felt this tendency as well. But the firm in quesiton was never dependent on financing by banks. It had always the *second possibility* ("zweites Standbein", Mr. M. 1:34) to construct turbines of common style for a yearlong regular customer. The customers' structure for the new kind of turbine is very interesting with respect to resistance. Customers of the firm can be indicated as bunches on the map of Germany. This speaks for a certain kind of mouth-to-mouth propaganda ("Mund zu Mund Propaganda", Mr. M. 1:120). According to Mr. M. it is not easy to convince potential customers with the new kind of technology. They look most often to the neighbourhood in order to decide what they are going to use (ibid.). In this respect they constitute another social world, i.e. one of power production with river-dams. With his knowledge and incentive, Mr. M. has brought – and is to bring (cf. Part III) –some important changes to the businesses of turbine construction and power production. This had not happened if the strong tie of *going concern* would not have changed the structure at this firm in order to make Mr. M. an entrepreneur.

To sum up this chapter, the social world perspective can offer some new insights into the realm of entrepreneurship. It is well suited for the investigation of emergent phenomena, i.e. establishing innovation into a market. Not only is the entrepreneur's own disposition in question. He is embedded in social circumstances that do, to a

certain degree, determine what is doable and what is not. This is not always a question of profitability in terms of money. Each social setting is built on certain ideas about morality. This can be important as seen with the delay in reproduction science's takeoff due to moral reservations. There are negotiations necessary between very different actors within society in order to just begin with innovation. Considering this is particularly important nowadays when investigating, for example, certain fields in biotechnology, as this field bears a similar moral reservation-structure as the field of reproduction did a century ago. The social words approach gives us an idea that it is not enough just to look at the entrepreneur, his knowledge and motivation. The social setting he is part of should not be neglected, as we would loose important insights. Furthermore, innovation is not merely a task that is conducted by sole heroes of industrialisation. It is a social endeavour:

> "Social world is a social arrangement that serves the emergence of awareness twofoldly: It is important for society when new, so far not recognised problems are to be solved or/and new forms of activity are to be developed; usually, this task of innovation is closely related to social and cultural inventions. [..] The structure of arenas, in particular, serves to define those problems that have not yet been recognised, and offers, if necessary, a stage in order to dramatise the problem by showing emerging differences in world-views [..] and scandalising and emphasising the scenario as a crisis[..].
>
> [..]
> Social world as a social arrangement can also offer a stage on which, as an ongoing process, societal problems and fields of activity are analysed analytically, debated discursively, and reflected critically. [..] This is the evolutionary function of social worlds in terms of production of knowledge and culture." (Schütze 2002: 68f., translation by SH)

Schütze outlines two features of the social world perspective that are at the core of this work. He denotes the creation of novelty on the one hand, and the evolutionary process on the other, as eminently complex social phenomena. This perspective takes particularly such phenomena like restriction and being conservative into account. They are the subject of ongoing negotiations and debates, on the level of tiny groups or on the level of the society as a whole. But Schütze is not reluctant to remark that those social worlds – by intersecting and segmenting, in short: amalgamating of different cultural fields – do contribute significantly to the dynamics of the evolution of cultural achievements (2002: 70).[55] A last quote from George Herbert Mead, one of the major contributors to symbolic interactionism, on which root the social world perspective rests, shows that this realm has always been open to evolutionary research and that evolutionary processes may happen on the micro-level, too:

> "The response of the 'I' involves adaptation, but an adaptation which affects not only the self but also the social environment which helps to constitute the self; that is, it implies a view of evolution in which the individual affects its own environment as well as being affected by it." (Mead 1932: 214)

[55] "Evolution kultureller Leistungen" (ibid.).

Part III: Methods and Frameworks for Researching Evolutionary Processes

As suggested at the end of Part I, evolutionary economics is supposed to be *the* grand theory (or meta-theory) of economics. This simply rests on the fact that no social theory can avoid the commitment to history, and history is to be described as an evolutionary process.[56] But evolutionary economics as grand theory is not a research method in itself. It rather encloses different research agendas. It makes this endeavour inter- and trans-disciplinary. Here, the question arises as to which research agendas meet evolutionary thinking best, and especially, what kind of method can contribute to assemble the big picture of evolutionary economics. Features like bounded rationality, restless change, contingency, and emergence are properties which are at the heart of evolutionary economics as well as of the social world approach. They are significantly different from elements of neoclassical theories, such like production factors, maximisation, complete information, and equilibrium. Therefore, evolutionary economists must discriminate between the neoclassical kind of empirical research and theirs. And even evolutionary economics is not a homogenous endeavour. On the current stage evolutionary economics has to face the problem that it still has to set up its analysis instruments. It has to observe the relevant data that can be used for modelling and population analysis. This last part discusses the possible implementation of some of the methods and frameworks that I have outlined, or sometimes only mentioned, in Parts I + II.

1 Exploring Social Worlds

As the evolutionary economic theory is still in a phase of its own development, certain research methods are more crucial than they would be in a mature discipline. According to Saviotti (2003: 18), there are explorative empirical instruments necessary in the emerging phase of a scientific discipline. Since data of the world – Saviotti speaks of observables – are too multifarious to collect them all, and because it still has to be defined and discussed what the necessary data should be, *explorative* instruments would help to find the important and non-disregardable observables. The identification of indicators that support or refute theoretical assumptions is a special need in the early phase (Saviotti 2003: 24f.). Concerning the division of labour in academia by exploring the society as a whole, the quest for indicators in economics has followed only certain traces and neglected others. Different social science approaches may help to fill the gaps. I may start with the social world perspective.

[56] Evolution is, of course, not the only way to describe historical processes. One might think of Hegelian and Marxian dialectics, or of finalism. I leave aside to discuss the value of such conceptions (and especially that of the opposing finalism) and let it be taken for granted that, if we agree with "history matters", we think of evolutionary history.

First of all, the social world approach offers a framework for case studies in its own right. Case studies can be done with many focuses. One important frame is the role of entrepreneur's activity within a firm or even a trust. As shown above, with the concentration of activities with respect to a certain *going concern* – e.g. entrepreneurship – we may have an interesting starting point to investigate inter- and intra-institutional relations like they are observable in firms. The benefit here is, that it is not restricted to official institutional ties but can involve all kind of informal relationships to a certain going concern. Entrepreneurship as going concern, for example, would involve such different actors like research institutions, technology suppliants and idea-contributors, even if they are non-professional but, say, members of the own family. The social world perspective with its focus on *going concern* and investigating the relations between very different kinds of actors allows reconstructing firms' development in a rather non-restrictive way. Furthermore, we may be able to identify the stage of an industry when we look at the primary activities of the involved firms. Clarke's scheme of the three stages – negotiations in the emerging phase, adding-on in the adolescence phase, restructuring in the adult phase – may offer a kind of taxonomy of an evolutionary development.

The difficulty with many case studies is, however, that the questions that are raised are often by far to narrow. This happens because the advantages and the potential of heuristic methods are often neglected or even condemned. Hence, in terms of evolutionary economics, one may even criticise that the potential of novelty generation is not used, novelty of ideas and therefore production of knowledge. Many of the social world studies that are done up to now use *Grounded Theory* as qualitative research tool (cf. Glaser and Strauss 1967). This method is based on a certain kind of oscillation between induction, abduction, and deduction.[57] The first task is gathering data and connecting them with first assumption about coherences. This will give you a first insight to processes in question. After a certain period you go to prove your findings deductively. Then – meanwhile you are on a higher level of your theory about the research area because your knowledge about it has improved – you start again gathering data and make meaning of them, and after a certain time you prove your findings again. The benefit is that, as we know now that we should not restrict ourselves to economic mechanisms, you do not have in mind any functional mechanisms about society whatsoever when you start your analysis. This is what you may want to have as your research outcome.

The social world framework is based on human action and interaction in particular. But there is no statement in the first place about the character of this activity. This may be part of the research outcome, too. We are not restricted to a framework of a certain rationality of human action. I say "restricted" not because I want to dismiss questions about rationality. Those can be very useful for some research topics.

[57] On abduction, cf. page 42ff.

For others they do restrict the research agenda, nevertheless. The whole neoclassical agenda is based on the assumption of rational man with perfect knowledge. We have seen how restrictive models are that derive from such assumptions. But even if we speak about theories and conceptions of rationality that complements evolutionary economics, such as Herbert Simon's notion of bounded rationality, it is a very broad, if not a too broad, analytical step to draw conclusions from such theories about the individual rationale to large aggregates such as the economic system. In the stage of exploring it would restrict unnecessarily the analytical frame. As seen in Part II, we have not made any assumption about the rationale behind human activity. What we are interested in is real and observable activity. If we want to avoid, at least conceptually, any kind of reductionism in a social world analysis, we must not restrict economic action to certain theoretical frameworks of actors' motivation.[58]

Furthermore with reference from the individual, or even from individual mind, straight to economic systems we would fail in taking many issues into account that, in real live, are blurring the relationship between individual and society. We can assume that entrepreneurship is not everywhere the same throughout the capitalist system of Western societies. Incentive structures are different as well as historically grown self-images and the image of entrepreneurship within the society. We can deduce this when we believe with Schumpeter and Witt that it is not profit alone, and probably not even in the first place, that drives entrepreneur's activity (Witt 2002: 13). Historically grown incentive structures are also to be seen, of course, as evolutionary developed. Now, when speaking in terms of the best possible research framework: What, in the current state of economics, is more important, for example with regards to policy-making? Is it the structure of the human mind, or should it not rather be the dynamic structure of observable circumstances in which human, and not least the entrepreneur, acts. No question, none of these research endeavours are unimportant in their own right and must not be neglected. But the academic realm is not separate from society. It is a social arena in the best Straussian meaning. Scarcity of resources is to be taking into account, there like everywhere. And scarcity always asks for priority, asks for what is to be favoured.[59]

The next step down the ladder of micro-observables would not yet be mentality. It would rather be the genuine social phenomena *speech* and *language*. Even if we assume with Wittgenstein (1953) that communication is possible despite many misunderstandings within small scope (family resemblance), in certain circumstances misunderstandings have yet economical consequences. We can observe those obstacles when we look to economical relationships between members of different cul-

[58] Other research frameworks, of course, ask especially for those factors. Here, we only postulate that any kind of action is possible. Quite like population thinking we look at the distribution of kinds of activity and its connectedness. The social world approach is a genuine descriptive research framework.

[59] This quite fierce argumentation might be seen, in the best Straussian meaning, as boundary setting and legitimating the social world called sociology.

tures. Communicative failures do happen on an every day basis. This might also be due to different rationales of individuals, of course. But the major reason is to be found in the communicative structure itself that differs within the society and especially between cultures. Exploring communicational structures with respect to evolutionary processes can potentially be a promising task within evolutionary economics.[60]

By employing the social world approach in order to do a case study we do not really know where this case will end up. In an exploring phase of a discipline this is especially important. But more than only a few case studies tend merely to confirm what they have predicted, or they just reflect the underlying knowledge structure in the field. The main reason for this is that a certain kind of implicated deduction does rule research.[61] Employing, for example, Grounded Theory as a heuristic means can prove to be very helpful to overcome such obstacles. The character of heuristics and openness for novelty might also be shown in what nowadays many researchers postulate: inter- and transdisciplinarity. An evolutionary approach may appreciate this because, likewise, it assumes that economic processes are not really predictable, neither by the researchers nor by economic actors themselves. The employment of heuristic measures is during the exploring state of evolutionary economic theories particularly helpful, if not essential. As Saviotti argued (2003: 19), in an emerging theory that is still developing its basis-assumptions, in which state evolutionary economics still is located, gathering potential indicators for modelling and theory building is an essential task.

2 Exploring the Innovative Process

a) Contingency and Abductive Reasoning

As seen in Part I the innovating process is paved with uncertainty and anything else than straight forward. In this respect evolutionary theorists assume this process being contingent. Contingency means the possibility to be different. It includes potentiality but excludes necessity as well as impossibility (Luhmann 1999: 152). The short version of it is: *something could have been otherwise*. That the course of history is contingent is well accepted by evolutionary economists (e.g. Metcalfe 2002: 9; Dopfer 2004: 187; Witt 1999: 27). The subjunctive mood "*could* have been otherwise" suggests that investigating these phenomena might be impossible. They did not happen; hence there is nothing to investigate. A curious mind is hardly to satisfy with this statement. Contingency does not mean arbitrary coincidences. Contingent outcomes are structured. As Alchian has shown we can, nonetheless, investigate the environment of selection, and can structure it analytically. But in exploring the field of economic evolution we must not restrict the research scope to a scheme that is too

[60] I will come back to this topic in the last section.
[61] Beginning with, for example, Karl Mannheim (1936) and Thomas Kuhn (1962), many studies in sociology and history of knowledge and science have discussed this topic.

narrow. Schumpeter, for example, divides strictly between invention and innovation. Only the latter is significant for his analysis of the entrepreneurial function. According to Witt, this division is rather "artificial" (2002: 14).[62] Taken for granted the requirement to abstract and to select certain phenomena for investigation, which could also be such a differentiation between innovation and invention, and even to build theories on them: The general framework of evolutionary economics must be an embracing one, and at the same time open for non-reductive research.

We need to enlarge our research scope on a fairly amount if we want to meet this requirement. Every economical activity consumes a certain amount of energy, or as Witt puts it: "a dissipative system like the human economy can increase its production only by increasing energy throughput" (2002: 27). Evolutionary economics as a grand theory has to take this into account and must not restrict its framework, or it will, due to simplifications in a closed theoretical system that causes contradictions, suffer the same shortcomings like neoclassical economics. This means also that we should pay attention to the phenomenon contingency. For, to state that *it could have been otherwise* does not mean automatically that nothing happened besides the defined. To remain in the realm of innovation research: We do not need to wait until an innovative product is adopted by the market and by imitators in order to implement them into evolutionary theories. By including actor's imaginary we can deal with facts as well as with possibilities, which, as long as they are communicated, are nothing else than facts in interactionism and phenomenology. Innovative activity, whether successful or not, consumes energy. It would not only be interesting what kind of product, service, etc. the entrepreneur has in mind, but also what kind of process he imagines (or was imagining in the past but did not realise). The potential of employing imagined paths in order to investigate entrepreneurial action might be pretty high, indeed. In fact, it could be the basis for an evolutionary theory of business-planes. Various kinds of in-depth interviews, observations of meetings as well as the review of codified imaginations such as the business-planes themselves might be appropriate research methods.

But how can we approach the phenomenon of contingency? Even the act of perception is highly contingent. To perceive the world means to draw a distinction in the first place. A part of the complex world is selected, since it is simply too complex to be noted as a whole. The selected part is indicated; the other part, the enormous larger one, remains unmarked (Luhmann 1999: 92ff.).[63] Drawing a distinction is, hence, the most basic operation of perception. This conception is similar to Campbell's idea of blind variation. In both theories do actors draw a distinction by deciding what is subject for acquiring further knowledge. And it is highly contingent what is selected as subject of distinction-drawing. This does not mean that it hap-

[62] Cf. also the quotation of Witt on page 26.
[63] In this Luhmann follows Husserl's (1931) phenomenological conception of directed consciousness on the one hand, and Spencer Brown's (1977) logical calculation of two values on the other.

pens randomly but rather within the frame of their present knowledge.[64] The question is now whether the not-selected can take a shape in order to be analysed. However, we do neither follow the Luhmannian direction, nor Campbell's. Both conceptions pay not very much attention to processes but argue rather from point to point. This may be explained with an example employed by Campbell:

> "[..] even in imitation, there is no 'direct' infusion or transference of knowledge or habit, just as there is no 'direct' acquisition of knowledge by observation or induction. [..] what the child acquires is a criterion image, which he learns to match by a trial and error of matchings. He hears a tune, for example, and then learns to make a sound by a trial and error of vocalizations, which he checks against the memory of the sound pattern." (Campbell 1987a: 68)

So far, we accept Campbell's conception of learning. There must be an active learning mechanism involved. Knowledge does not flow into somebody's mind. But does Campbell describe a process of knowledge acquisition? I think, no. There is something missing. When the child makes his trail in imitating the sound, he makes it not randomly but is using the knowledge he has acquired so far. In this we are still with Campbell. But now comes the difference. We are interested in what makes the child forming his tongue in a certain shape and not in any other in order to create the sound? Campbell suggests that the child learns ex negativo, means that it tries blind by avoiding the kind of shapes of the tongue that, according to the child's present knowledge, cannot match the sound. But what kind can? A deep sound needs another shape of the tongue than a high one. The child knows at least approximately which shape the tongue must have in order to match the sound.

The child's awareness that he may *approximate* the matching is exactly what abduction means, and what in Campbell's scheme does not happen. Strictly speaking the latter is a-historical and static. Trial in this scheme is a point-to-point activity, even though the following trail incorporates more knowledge than the former.[65] Campbell's trail and error scheme has to converge to an infinite shortness of trials in order to represent a process. At this point this scheme becomes unhandy for empirical research. With abduction, on the other hand, the child is able not just to guess into the blind but also to assume that a certain shape of his tongue comes nearer to match the sound than another shape. This is a hypothesis and, if you like, a very basic form of doing phonetic science. Campbell's scheme does not incorporate the usage of hypotheses. Here, on a certain stage the act of trial is blind.[66] With abduc-

[64] It will be at least as long contingent as we do not have a continuous theory about the biological preconditions of human decision making. As up to now neurobiology can explain hardly more than the amount of firing neurones during certain mental states – which is fairly interesting in its own right and may even contribute to questions about human preconditions in certain situations (e.g. with mental illness) but cannot answer the question whether the whole historical course is determined or not –, we must work with the scheme that is available. We cannot assume any determinative structure in the act of selection of the subject of distinction-drawing. This, strange enough to criticise natural scientists with the following, would be a metaphysical assumption. The only determinant available is the state of the present.

[65] Popper speaks of "trails [..] on a higher level" (Popper 1987: 117).

[66] Popper describes this logic of blindness aptly: "we may still not know where the black hat is, but we may know (or we think that we know) where it is not." (Popper: 1987: 118) This characterises the whole process as ex negativo. Abduction, on the other hand, allows assuming where the black

tion the act of trial is never blind but rests on assumptions. The actor has a certain theory in mind of how to reach the aim. He might not always approximate and sometimes even be completely wrong, but, however, this is not the question.[67]

Closer to abductive reasoning comes Edward Constant when he characterises the creativity of blind variation as the "If" component in an statement like "If I tread a turbine or axial compressor as a set of aerofoils [..] then I can analyse them according to the theory of …" (Constant 2000: 230). The "then" component is a deduction. Abduction in the meaning of C.S. Peirce (1931-1935/1958), however, is concerned with deduction only in a later stadium. The child's idea to use the tongue in a certain manner is more a matter of instinct and subconscious reasoning rather than of rational reasoning (cf. footnote 72). In this respect Peirce is referring to psychological and biological preconditions.[68] In many situations the mood in which abductive reasoning happens is crucial. For our purpose such a broad view might be helpful. With abductive reasoning we may speak of *blurred* rather than of *blind* variation.

Now, we should have a concise framework in order to deal with such phenomena like contingency. For this is the same situation the entrepreneur himself has to deal with. In the same way the observer interprets the situation of the entrepreneur as contingent, he himself is (more or less) aware of contingency – that there are several outcomes possible and several ways to reach them. And therefore he creates hypotheses in order to cope with this situation. By participatory observation and interviewing we are able to investigate such processes in detail. We could recapitulate what kind of heuristics the entrepreneurial actor was using, what his incentives where, how in detail he was facing uncertainties, and how he has coped with them.[69] However, we do not need waiting until an innovative product is launched. It is conceivable that even if there is no output observable in terms of innovation, we could find many activities that show exactly the process of innovative action. Those belong to the economy as they consume energy in Witt's meaning, and they may contribute to its development, for example by making available trained and with new

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hat *could be*. It emphasises the question: *How* is novelty produced? Popper, on the other hand, starts with his analysis not before the novelty is observable.

[67] Philosophy of science is in ongoing disputation about such kind of inferences. Popper, for example, would insist that this is not refutable and hence not scientific. I will not follow such discussions, because here is not the place to do so. But even if it would not be a proper logical inference for science, we are not interested in questions about scientific knowledge, neither how people *should* behave but about how they *do* behave – normative vs. descriptive. Btw., critiques like this have been raised by many of Popper's philosopher of science colleagues. Hilary Putnam, for example, argues that evolutionary theory itself is not falsifiable and a product of abductive reasoning: "[..] we accept the Darwinian theory of evolution by natural selection as what Peirce called an 'abduction', or what has recently been called an 'inference to the best explanation'. This is exactly the kind of inference that Popper wanted to *drive out* of science; but scientists are not going to be persuaded by Popper that they should give up theories which are not strongly falsifiable in cases where those theories provide good explanations of vast quantities of data, and in cases where no plausible alternative explanation is in the field." (Putnam 1981: 198)

[68] I may add that his interpretation likewise involves sociological aspects.

[69] *Narrative-biographical interviewing* (Schütze 1983), for example, has proven to be a good research instrument in order to investigate stages of, and processes within, people's "lifeworld" (Husserl), of which the process of an actor's innovative ambition is a part.

knowledge equipped workforce.[70] However, the unit of selection in evolutionary economics is a form of "transformations [..] of matter and energy" (Metcalfe 1998: 26), and somewhere within the non-reductive frame these activities are clearly units of selection.[71]

Coming back to the logic of abduction we can adopt a sort of abductive reasoning that does even express creativity. Above we have seen a type of approximate abduction. It is concerned with plausibility such of the kind: "*this might be the most reasonable way*". But a likewise interesting, or even more interesting version is the second type of abduction: *creative abduction*. It allows the discovery of generality. Remember here that deduction cannot discover at all and induction only single events. Gerhard Schurz shows the difference between these modes of inference by employing an example that Peirce has often used (Schurz 1995: 5f.): A diamond is able to scratch all other objects. We conclude abductively that a diamond has the character of maximal hardness (inference from experienced effects to the non-observable cause). We could, furthermore, conclude that each object with the character of hardness is able to scratch objects that are less hard. The latter is a creative abduction because it introduces a new regularity.[72]

b) Innovation and Imagination

We may use these types of abductive reasoning in order to outline an innovative process. An entrepreneur imagines *a possible product*, service or whatever (conclusion).[73] Then, he imagines the product that he concretely wants to innovate, and maybe the potential profit on *this product* (case). And then, he looks for a path (hypothetical rule) that leads him to this outcome. Different from induction and deduction, the hypothesis itself is the phenomenon in question. This is the approximate abduction. But creative abduction is involved, too. The entrepreneur imagines first the difference between the innovation as abstractum (product in general) and the concrete product that he wants to push into the market. To draw this distinction

[70] We can imagine how much activity has happened during the dotcom-phase, and how many ideas were not realised. Nevertheless a co-evolutionary outcome even by those activities is the well-trained workforce (beside other consequences like those shaped by consumption of high technology products etc.).

[71] It is, however, not an easy question what ontological status a product has got that had been revised in a way that it vanished completely. We may, for example, think of a tiny novel program code that only existed for several minutes. We may tend to ignore this novelty, and give it the status: *not adopted*, therefore not existent. But this is not really true. In a strong and rather philosophical meaning, to write this code has been transformation of energy; in a pragmatic or empirically observable meaning, it might have caused shaping an innovative capacity to the person who was writing this code. It could therefore be consequential for future innovative processes.

[72] There are ongoing discussions about abductive reasoning in the work of C.S. Peirce. These concern, for example, an earlier version of abduction that follows classical syllogism in opposition of the later version that is more concerned with reasoning in surprising situations, and which contains a Darwinian explanation, i.e. a "guessing instinct", cf. Wirth (1998). Or there are the different expressions that are used more or less synonymously, such as *qualitative induction* and *retroductive reasoning*. Scholars have interpreted all those issues in many different ways (cf. ch.3 in Reichertz 1991).

[73] Rather than seeing the outcome as his product in a naturalist sense (philosophically), he may classify it as a typological entity. And if so, he may reason about the very different characteristics of this product apart from the ones he is to use for his purposes.

could, for example, offer a starting point to investigate the entrepreneur's ignorance concerning the threatening imitation process that will follow as soon as he has launched his product, and the following decrease of his returns (cf. Witt's critique on the Schumpeterian entrepreneur, footnote 14 on page 13). A differentiation between the entrepreneur's concrete product (not jet realised) and the product in abstract would mean that, for example, the entrepreneur anticipates different usages of the product that he is not prepared to realise (because of costs, lack of knowledge concerning specialties or the foreign market, lack of time and money, just contentment with the anticipated situation which would, in passing, speak against profit-maximising, etc.). The entrepreneur is not only approximating a certain outcome. He is creative in twofold ways as he is creating a product and formulates generalities about the usage of it.[74]

The following example may show an abductive research scheme in practice. European law ("Lachs 2000", i.e. Salmon 2000, cf. 1:63) requires reconstruction of nearly each existing dam that impedes fishes to pass it. This means large investments for the communal bodies that run existing dams without any kind of fish-passage. A planning person ("Der Planer", 1:68) asked our firm whether it would be possible to built turbines that could be implemented in small dams – as the most of the dams that are called for rebuilding are relatively small – in order to offer a flow-through for fishes on the one hand, and power-generation within this flow-through on the other. Power generation ought to serve as reinvesting means for the reconstruction. As existing turbines are in the most cases too large – especially because they should not be implemented in an extra channel outside the riverbed, which has been done most often in the past – a new kind of turbine is in question.

The problem here is, as seen in Part II, that of *doability*. First, it is not doable to use existing types of turbines because they are apparently uneconomical in small dams. The lower the heights of which water can fall (difference between the surface of the water on the two sides of the dam) the less economical is power generation. Second, only within the last two decades it has become possible to built smaller turbines. This is due to technological developments of generator specificities ("Permanentmagnet-Generator", 1:91) that allow building smaller devices.[75] Furthermore, ideas like overpressure within the turbine (1:70) allow operating the turbine under the surface of the water. Third, doable is this kind of power generation only when construction costs remain in a reasonable frame. That shall be guaranteed by standardised construction of the turbine itself as well as of the site (1:95).[76] Fourth, doable might this project only be because of cooperation with the Technical University

[74] Well-known examples for this kind of generalisation are observable when Bill Gates (Microsoft) or Steven Jobs (Apple) lecture about the future of office-work and of recreation in living rooms, and their technology that would lead to this life style.
[75] The outcome might be classified as a co-evolution of technology.
[76] Mr. M. mentioned many more demands that this concept is to meet, e.g. environmental reasonability (1:74), fish-protection (1:77), flooding-protection (1:78), adaptive to the scenery (1:79), time of construction (1:83).

of Stuttgart (funded by *Deutsche Bundesumweltstiftung* DBU, cf. 1:99). It, on the one hand, offers simulation techniques that shall show the reliability of the new kind of turbine; it serves, furthermore, as a marketing device because it is suggesting an image of respectability to potential customers.

Up to now we have characterised in passing the social world of innovation of this new kind of turbine with members like the dam-owner as potential customers, the "Planer", our firm, the Technical University of Stuttgart, and the funding foundation DBU.[77] Whether this project will be successful in future times we do not know yet. It has not been realised, yet. But this project is far from being not existent. Up to now, very much energy has been used in form of negotiations, travelling, time spending, theoretical and blueprint constructions, PowerPoint presentations, and, of course, knowledge production (simulation of something new, i.e. simulation of the new turbine; implementing of new kinds of grease-techniques and power-generation procedures; implementing overpressure-techniques). The latter happened not very much as Campbellian trial and error procedure up to now. What is to be built is clearly marked: a turbine that is very small and is running in an overpressure-case in order not to be seen on the dam. It is also constructed theoretically, on the computer. This has happed with available knowledge and with strategic measurements that rely on this knowledge. Up to now there are not any remarkable mistakes observable.[78]

We can imagine processes of more or less trial and error. Michael Hård (1994) shows aptly how different the development processes of the diesel-engine were in the US (trial and error) and in Germany (science based) at the beginning of the 20th Century. David Perkins (2000), in order to classify such different mechanisms of invention, speaks of different search strategies in a "Klondike space". The latter represents the environment in which inventions happen: "wilderness gap" as an area with sparse viability; "plateau gap" with more viability but without directional hints to larger fitness; "canyon trap" that offers nearly no viability; the "oasis trap" promises a high amount of fitness (but not the maximum, which lies on the high peak). Those different areas call for different heuristic strategies. Transferred to design-

[77] The role of the "Planer" is of particular interest. He has, of course, not initiated this whole new idea because of altruism. As explained, to run those turbines shall be without costs as well as without any benefit from power production to the communal owners of the dams. The plan is to get the owners' rights of using the water-flow ("Wasserrecht", Mr. M. 1:67) and making money with this kind of power production. This would be an innovative business model. In this respect, using the social worlds concept shows how such different actors like engineers and finance experts can contribute to several innovative products simultaneously – a new kind of power production on the one hand and a new kind of business model on the other. They "de-correlate" existing knowledge (technological specifics of turbines and investment models in power production, i.e. engineers as manager or investment-partners in power production) by correlating common knowledge of very different realms in order to create new business possibilities – in this case even two-foldly. That scientists and engineers are investors of their own products is not a new idea. But it might be rather unusual with this kind of engineering. De-correlating existing knowledge, i.e. disturbing a commonplace that is build by existing common knowledge among individuals, is exactly what the economical function of Schumpeter's entrepreneur is (Metcalfe 2004: 167f.).

[78] Just to remind, we are not interested in philosophical questions about knowledge production but look for a pragmatic empirical framework. Of course, it can be stated that these processes can be downsized in order to reach the scheme of trial and error (e.g. by showing how the computer simulation is done).

fitness, in the wilderness and plateau area we may choose a high amount of variation in hope of finding an adaptive form; in a canyon we may only escape by doing something completely different; in a hilly area we improve our design (though we may not know whether it is only an oasis trap or the hill of the highest peak).

The latter case may fit to the inventive process of the turbine in question. As shown, Our firm is going a straight way of improvement of existing technology in a quite adaptive environment. In terms of design this kind of turbine is possible to develop.[79] The technology is available; costs and circumstances of implementation will be reasonable in order to meet the customers' needs. Furthermore, the market must not be created, e.g. by marketing, but customers are awaiting an adoptable product. Variation of possible designs and marketing processes is not necessary. (Variation is one of three strategies that Perkins mentions.) It is rather a combining process of the other two search strategies. It is first a revision of an existing turbine-type – "adaptation by revision" (Perkins 2000: 164f.); second, it is a process of implementing new technology by constructing via blueprints, simulations, and, forthcoming, building a research-prototype (1:105): "adaptation by coding" (Perkins 2000: 166) or "hill-climbing" (2000: 172). Right from the beginning, the steps that our firm went were quite clear. But, of course, at the beginning only the product has been imagined. Then, the path in order to build this kind of turbine was imagined (hypothesis). Up to now the development has happened without bigger errors. Within an abductive scheme we are able to describe this path as approximation to the end product. Campbell's trial and error scheme seems to be not the appropriate one in a situation in which the path is straightforward like in the example above.[80] Campbell's scheme may rather work if we have indeed *variation* as research strategy in very uncertain and unknown situations, i.e. innovation in the wilderness and plateau gap, and maybe in the canyon trap in order to escape. But then counts as well: People have ideas rather blurred than blind, and imagine paths of solution without deductive reasoning.

Coming back to imagination, we may have a look to the second kind of abduction: creative abduction. Mr. M. does not only think about the product that he wants to implement into a dam. He has also other ideas about the potential of this product, once it is working. He has imagined, rather implicitly and without working these things out properly, new markets for this kind of product, e.g. to implement such turbines in sewage purification plants (1: 164) and water reservoirs (1:165). Concerning the latter Mr. M. has given a hint that he sees competitive threatening rather

[79] The only concern with respect to technological issues raised Mr. M. with the so-called "cavitation". This happens when water loose its gases during a process of facing different pressures. The small gas bubbles can destroy the turbine's paddle (1:32; 1: 56). This problem restricts the design of the turbines in "real-world" like Vincenti (2000) has shown with some historical examples in which real-world circumstances restricted the technological design (e.g. the crash-down of the Tacoma Narrows Bridge near Seattle).

[80] Rather more beneficial could the abductive logic as hypothesis be, when we do in-depth interview with entrepreneurs. We could, for example, try to look for ad-hoc business planes that were never realised but in the minds of the people. Those are also products of abductive reasoning.

composedly. Now, there is no intention to implement power production at water reservoirs, but such usage schemes are seen as an option for the future, in Mr. M.'s words: (*beforehand, Mr. M. is talking about technical problems*) "these problems would have to be sorted then, when the current project will be done, and if anybody else is not faster" (Mr. M. 1:165, translated by SH). Mr. M. would most probably not show this calm mood if he has to face competition in the current project, in which is already involved a high rate of investment.[81]

As seen, a product can be interpreted in multifarious ways. But this happens not only by entrepreneurs. Many sports fishermen, for example, see turbines in dams as fish-killing devices (1:62; 1: 170). But in general this kind of technique that is to contribute to a decrease of greenhouse gases is seen rather pleasantly. We can imagine other examples, e.g. in biotechnology or in military-technology, where the situation is completely different. These are phenomena that make the innovation process a very heterogeneously looking endeavour, depending on the field of innovation. We cannot speak about innovation in general but must always add: innovation of what, or in what field. But nevertheless, this can be investigated with phenomenological means. Fridrik Hallsson (1999), for example, has developed a scheme of very heterogeneous perception types. All three types of inference can happen within this framework, depending on the social setting. We must differentiate, for example, between biographical time and large time spans and, furthermore, explore the nearness of societal realm concerning an innovation (e.g. reproductive and biotechnological products as very near to the social, and turbines as less near, but due to the environmental topic still nearer than the Hubble telescope). Hallsson's scheme of 18 foreign figures, of which one innovation can incorporate several at once, could help to differentiate innovative activity, classify what kind of social fields bear problematic innovations, in which social fields do certain innovations produce heroes, etc.

People's imagination can prove to be a very powerful source for research. If we were able to get a critical mass of well distinguishable imagination patterns by entrepreneurs, investigated by qualitative studies such as observations and in-depth interviews, and if we were able to build a kind of taxonomy, we could even employ population analysis in order to investigate characteristics, for example, of business-planes, their development over time, local and chronological differences as well as topical ones. We could compare them with realised business-planes and draw conclusions, for example, about the gaps of imagination and realisation. We may find fields in which these gaps are bigger than in others. We could, furthermore, try to build a systematic taxonomy about kinds of innovations, for example whether there are more or less social debates about them, or whether they need more or less trial and error schemes, more or less abductive reasoning, etc. Once we have standardised

[81] Generally, competition in this section is not very high. Few companies went bankruptcy because they used only old technology. But with firms that are in a certain kind up to date, their subsistence is not threatened (1:148 – 1: 150).

such phenomena, and have a taxonomy about them at hand, we would be able to investigate the entrepreneurial world with means of population research. We could measure the distribution of those phenomena: What kind of innovation bears more difficulties than others, in what field of society is innovation more difficult, what are the obstacles that hinder innovations, how do innovative search schemes (variation, coding and blueprint search, hill-climbing) change vertically over time and horizontally in terms of region and topic? These are only view possible research themes that could lead to a big picture of the economic phenomenon of innovation.

After all, with including imagination and not realised innovations we would be able to open up a contingent, and hence a covered business world. If we imagine how many ideas are not realised, how wasteful evolution is, but how much time and financial resources is used in order to shape these ideas, we may come to an end with the analogy to *dark matter* in astronomy. We may find that those not realised ideas are so substantive to capitalism that, just like the theory of expansion of the universe due to dark matter, the expansion of the capitalist system cannot be explained without implementing imaginative and not realised phenomena into a research scheme. This study would deal with *facts* rather than just fiction as it might look like in the first place, because these phenomena are functionally connected to the real world – even physically due to time-spending, financial resources, and manifestations in documents, negotiations, etc. Contingency in this respect means that imaginations (and inventions) can most probably not be excluded in the sense that Schumpeter suggested. Within a (conceptually) non-restrictive framework of evolutionary economics it should obtain a position in its own right in order to fulfil the needs of the scientific division of labour that is not least the character of economics, no matter which kind of.

Exploring entrepreneurship can be a great task and it is supposed to be very much more heterogeneous than most economists would expect. However, we do not need to implement all these different phenomena that are in question when we build models or doing population analysis. This is not what a non-reductive evolutionary theory requires. On the contrary, it would mess up the whole scheme because we *must* abstract and simplify in order to make proper statements. The question is whether we can neglect them when we build models or do population research. The question is further, whether those phenomena can give reason to rebuild existing economic models or to set up completely new ones. We should at least have variables at hand that take such phenomena into account as soon as they could cause any impact to statements that are outcomes of modelling or population analysis. Therefore, in the exploring phase of evolutionary economics we should be curious about what do different social-science research-schemes have to say to the entrepreneurial activity. We may sum up our request with Saviotti:

> “We do not expect that the new world-view will give rise to a general theory, capable of explaining all observable events in any discipline. In a sense this general theory would be in con-

> tradiction with the newly emerging awareness of the limits of knowledge. However, sharing a basic framework constituted by some general concepts, metaphors and tools can both give inspiration to ask new questions, and provide coordination between different disciplines." (Saviotti 2003: 5)

3 Communication as Evolutionary Phenomenon

Evolutionary Economics struggles in its attempts to search for the reliable minor structures that could be investigated in the scheme of variety, heredity, and selection. Ulrich Witt (1999: 22) asks: "What are the economic entities whose representation over time is supposed to be changed in a systematic way by selection?" Witt discusses the possibility to put some economic phenomena into a Darwinian evolutionary scheme that we have treated in Part I, e.g. consumer goods and services, and firm's routines (1999: 23f.). His conclusion is, as we have seen likewise, that this bears many difficulties, especially due to the capability of learning and reflexivity (Lamarckian evolution). In terms of the evolutionary process, with the principles of variety, heredity and selection, phenomena like imagination and environmental circumstances, introduced in the former sections, are even more difficult, if not impossible, to handle. They may rather be treated and investigated as epiphenomena, just like epigenetics is concerned with the environment of genes, the phenotype.[82] However, Witt's solution to face the difficulties that occur when investigating the economic evolutionary process is to avoid Darwinism (1999: 24). In the reminder of this work I want to refer to a phenomenon that is at the heart of the evolution of society: *communication*. Understanding communicational bits in analogy to genes may bring the Darwinian scheme back into the focus. They tend to have a rather stable structure once they are introduced into the society. Researching communication structures may be interesting for some questions that are raised by evolutionary economists.

With Luhmann, we will again start from scratch in order show resemblances to genes. According to Luhmann "variation can be seen as an unusual message, but also – and probably more often – as a non-expected *non-acceptance* of a message" (Luhmann 1997: 459, translation and emphasis by SH).[83] Hence, it is a communicative contradiction to expectancies, i.e. to the conservative force of "as usual" (1997: 461). According to this, variation, in the most cases, is not the outcome of constitu-

[82] In fact, epigenetics brings the Lamarckian scheme back into biology. According to epigenetics characteristics obtained by the environment can indeed be inherited. The genes themselves, the genotype, do not change, but there are mechanisms in the chromosome (e.g. the structure of the chromatin, or methyl groups) that activate, or inactivate respectively, genes. These mechanisms can change and be inherited. Karberg and Friebe (2004) mention an observation that descendants of parents that suffered a famine in Amsterdam, Rotterdam and The Hague during World War 2 show a significantly high risk of suffering obesity, diabetes, heart-disease and cancer. This counts even for grandchildren. It is assumed that these inheritances are caused by inheritance of a certain structure of methyl groups that can change in a lifetime and inactivate genes.

[83] The term "non-expected *non-acceptance*" refers to the conservative forces in communication. In order to be adaptable we do most often accept offerings of communicative meaning. Harold Garfinkel (1967) made many experiments, in which he interpreted communicative offers differently on purpose in order to disturb the communication, for example: *Hello, how are your doing? / Oh I am feeling very bad, I have pain and a headache, and yesterday my teeth hurt the whole day.*

tions of something new, but of constitutions of something with negative relations to existing elements.[84] It is, therefore, a function to link up communication, even if afterwards the potential content of communication – meaning – is more heterogeneous and tents to bear conflicts. As everyday life is full of such communication, those conflicts are in most cases trifling ones; they show the characteristics of a bagatelle (1997: 462).[85] However, such communicative objections happen, and they are the main driving force of evolution. If they are adopted, conflicts will occur, and these are the fruit of the evolutionary process: "When a No wins as an outcome of a conflict, we can assume that this No has passed a first test and proved its staying power." (1997: 466, translation by SH)

In the course of human history rejections of the content of communication, meaning, has been a very common issue. In early stages it had, comparable to nowadays, no big consequences. Most often rejections have been forgotten. With the development of writing this was changing. The ability to store such rejections led to the ability to face them later on and without the necessity to be present during the communicative act. This led to an increase in the amount of further variations (1997: 464). We see how remarkably similar this conception is to Schumpeter's conception of innovative action. The entrepreneur, likewise, disturbs a harmony and has to pass many tests and to prove staying power in order to challenge the conservative environment. But it is this kind of negative force that causes the development of the economical system. We see, furthermore, that this kind of communicational evolution has nothing to do with learning effects (like routines), nor with the problem that they are assembled out of heterogeneous pieces like products and services. Communicative acts like those described are, just as genes, indeed describable as mutating, or as erroneous copies if you like.

Investigating communication may promise to open up a rather different field of economic research with regard to evolutionary processes. When we just think about the emergence of new expressions since the beginning of the 1990s, i.e. since the adoption of the World Wide Web, we can imagine interesting questions about the course of evolving of this rather new field of business. Other sources could be business journals or newspaper sections. Works in Corpus Linguistics – e.g. using the corpus of business languages (Nelson 2000) – may offer a starting point in order to implement the usage of language in evolutionary research. It may at least be a supportive tool to understand certain characterisations of economic fields.

[84] This resembles the notion of "de-correlation" of knowledge (Metcalfe 2004: 167). Luhmann does not discuss the character of novelty ("an unusual message"), which is the first case and more seldom. We can assume that even the most unusual message does not evolve from scratch. It might be a negation of communicative meaning as well, even if a very obscure one in which we cannot find a connection to existing messages. I will not go any further to verify this assumption, as it is not of sufficient importance in our case.

[85] Probably not trifling to psychologists, nor to sociologists with close relations to social-psychology. In such perspectives the extension of what is trifling and what is not might be larger.

Another field could be to investigate linguistic pragmatics, i.e. the intentions that are involved by using certain communication patterns. Communication patterns, once successful introduced, are relatively stable. We may associate them with genes. Then we would have to find an economic environment in which these idioms play the relevant role. This might be rather difficult, but as learned from philosophy of language, and of course from sociolinguists, usage of communication patterns means action, hence it means human behaviour. In his 1993 book, Michael Lynch named a chapter instructively "Molecular Sociology", that sets up a research program which is based on ethnomethodological studies of conversations (Lynch 1993). The so-called Conversation Analysis investigates the micro-structures of human conversations. Since the early 1970s Harvey Sacks and others (1974) have been investigating actor's technique of "turn taking" during conversations. In saying that this is a *technique* they insist on the context-free and stable character of this kind of action. This makes it interesting for our purpose. Like techniques in genetic engineering, where evolutionary processes are simulated and reproduced, such *techniques* are stable and basic; and like a gene pool, combinations of them build a certain structure of conversation. A lengthier quotation of Lynch may illustrate this:

> "A key difference between a microsociology, in which individual actors are the most elementary constituents, and a molecular sociology, in which embodied techniques are foundational, is that the latter units are essentially plural and heterogeneous. There is no idealized concept of the fundamental sociotechnique parallel to that of the social actor. [..] Instead, CA's [i.e. Conversation Analysis, SH] molecular sociology begins with a conception of social order in which different combinations of heterogeneous techniques produce an endless variety of complex structures. This conception is distinctive for the way it is social structural all the way down. The basic unit of analysis is not an ideal-typical 'actor' or 'self' but a plurality of socially structured techniques through which orderly social activities are assembled. The research agenda is to unpack these molecular sequences." (Lynch 1993: 258f.)

Lynch is clearly in the line of population thinking. He also rejects essentialism when he argues against the "ideal-typical 'actor' or 'self'". The analogy is rather based on praxis and technology of genetic engineering than on the natural gene-based evolution:[86]

> "The analogy [..] is based [..] on the production of routine molecular biological techniques. [..] The 'social molecules' in this case are not small 'things' to be scrutinized scientifically but are sequences of observables and reportable technique that compose a scientific investigation." (1993: 259f.)

It is still a long journey to obtain well-defined patterns of communication-techniques in order to use them in evolutionary economics. We can imagine the mere amount of conversational techniques and how manifold structures are that those techniques build in every day conversation, even if we are concerned with a narrower social setting such as economic action. To quest for the relevant communication patterns, the social world approach might be helpful, again. With its concentration on "going concern" patterns it could demarcate the potential pattern environment. As seen,

[86] In fact, it is a kind of a threefold analogy: Genetic engineers replicate genetic evolution with the biology's own means (Lynch 1993: 261), and social communication follows such patterns, too.

social worlds can be related to certain economical territories that are not shaped by institutional borders but by patterns of activity. We have discussed how to observe such patterns. However, the social world perspective could serve here, as well, as an exploration frame in order to demarcate the relevant patterns of communication.

All kinds of manifestation of communication can be taken into account. Up to now, there is done a great amount of work, for example in linguistics. We could refer their data to our interpretative scheme of evolution of the economy. We could also investigate certain periodicals that deal with a certain kind of innovation. What words are used in a periodical, in what context, and how do those words change? Dopfer's notion of *efficacy* is interesting here. Only "*efficacious cognition* and *efficacious behavior*" is successful within the economic system (2004: 188). With regards to population analysis this means that the amount of such cognition and behaviour increases. Using this framework, but employing instead of cognition or behaviour its social manifestations, i.e. words and expressions on the one hand, or communication patterns on the other, we could state that in a certain field an increasing amount of expressions or communicative patterns over time are more or less adaptable, and hence more or less efficacious. As Metcalfe at al. argue (2000: 12): "Evolutionary theories are naturally accounts of the rate and direction in which the world changes." Our aim would be to investigate "the rate and direction" of change of an innovative field with means of investigating the population of expressions and communication structures. Population research is probably one of the most powerful tools for future evolutionary economic research. Communicative patterns, due to their stable character, are especially predestined to be used in this respect.

Conclusion

Simplification is necessary in order to build concise models. But it can be dangerous and harmful if models are not revised, even if this would mean to dismiss them as a whole. Neoclassical economics may have proven to display the economic world when it is in a rather static state. But it is not able to explain the most important phenomenon that causes capitalist dynamics: introduction of novelty. When thinking about the dynamics of the capitalist world, Josef A. Schumpeter's theory about the entrepreneur deserves remaining recognition. From our perspective from ninety years after his *Theory of Economic Development* one might ask why this important insight does not let to a dismiss of neoclassical frames that try to explain economic development without explaining emergence. Other economic fields suffer similar discrepancies between theory and real life. When Pierre Bourdieu (1997) complains that social workers must repair what from neoclassical theories inspired policy-makers have carried out, he refers to nothing else than to critiques about conjunctures of perfect knowledge and profit maximising motivations. Like in social politics these assumption have nothing to do with the real world in entrepreneurship. If information, and hence knowledge, was available by anyone at any time anywhere, and if anybody wanted to maximise his profits, we would have indeed an equilibrium state. But we would not have any development or progress.

Evolutionary Economics is a promising endeavour in order to give a concise picture of the capitalist system. Unlike neoclassical economics the evolutionary framework deals with the human being as it is not as it should be. Not least because of this is it a rather open frame that allows other social-science disciplines taking part in its endeavour. The many approaches of evolutionary economics that try to explain motivations, preferences, bounded rationality, historical chance, etc. lead, nevertheless to one problem. They explain only certain characteristics of the evolutionary economic project. They are not the theory itself. Rather they are (important) parts of evolutionary economics as a *grand* theory. As Ernst Mayr argues in the epilogue of his large monograph about biological theories, and in the context of his desire to employ population thinking in science studies: Robert Merton's work on the scientific actor is not the theory of science itself but only a part of it, even though an important one (Mayr 1982: 830). The big picture still waits to be drawn, in science studies as well as in economics. Concerning the latter, it has to be assembled around mechanisms that have to do with emergence of variation, heredity, and a process of selection.

Evolutionary economics is a promising field in which other social science disciplines can find their home. Herbert Simon's notion of 'bounded rationality' has opened the economic realm to very different academic fields. I am not sure whether the consequences of this release – the abandonment of time- and contextless rationality – are considered yet. This might be the starting point for many disciplines that

never followed such conjectures. One possible framework is that of social worlds with its handy focus on primary activities. It shows some possibilities to think of the entrepreneur's function in more detail. We have discovered, for example, that on certain stages not only extra thought capabilities are necessary, but also the ability to negotiate. Furthermore, we may classify the entrepreneur's characteristics like will to conquer and certain identities not as phenomena of individuals but as shared in groups. Things like innovations must be doable and that is often a matter of negotiations among social members – individuals as well as groups. The social world approach is able to portray such processes of negotiations. It has even been used to interpret organisational development in an evolutionary scheme. I have suggested using such a framework for exploring social observables that could constitute the basic elements in modelling or population research. Especially the evolutionary economic theory of the present, which is still in an emerging state, should be open to the social sciences' multifarious attempts to offer a picture about the world we live in – just because it postulates itself the importance of variety in early stages of development in certain economic fields.

The picture of evolutionary economics has necessarily remained incomplete in this work. The institutional strand, game theoretical approaches, as well as the whole field of economics on industrial and technological development that is part of, or at least closely connected with, evolutionary economics could not be dedicated. The same counts for questions about the evolutionary process itself. Selection processes as well as the characteristics of the units of selection are by far more complex than I could show in this work. However, there may have been raised some interesting questions for further research. There is, for example, the notion of *contingency*. The explanatory power that may lie in the existence of not realised possibilities on the one hand, and in actors' imaginations on the other, should not be underestimated if we assume that an evolutionary process is very wasteful. In Part III there were suggested some points on which investigation of such phenomena could start. Many social phenomena must be taken into account that are between the individual's psychological disposition and an economic system. This is another outcome of this work. The mistake should be avoided to substitute one model of oversimplification for another one that will show similar discontinuities in near or far future.

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